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No. 95

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CONTENTS

PEOPLE'S REPUBLIC OF CHINA

APPLIED SCIENCES

China's First Scientific Satellite Launched
(Jiang Bin; HANGKONG ZHISHI, Mar 81).. 1

Double Canard Aerodynamic Configuration Characteristics Detailed
(Wang Baoxing; LIXUE YU SHIJIAN, May 80).. 6

Remote Control Airplanes Used in Aerial Photography
(Liu Bingqi; GUANGMING RIBAO, 23 Mar 81).. 17

Ultrasonic Fuel Emulsifying Technique Used in Steel Refining
(GUANGMING RIBAO, 19 Nov 80).. 19

SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

Research on Tectonic Framework of Beijing District
(GUANGMING RIBAO, 19 Feb 81).. 21

Unique Achievements of Lanzhou Desertification Institute
(Wang Lichao; GUANGMING RIBAO, 19 Feb 81).. 23

PUBLICATIONS

Table of Contents of 'FEIJINSHU KUANG,' November 1980
(FEIJINSHU KUANG, 28 Nov 80).. 24

Table of Contents of 'GUTI LIXUE XUEBAO' No 1, 1981
(GUTI LIXUE XUEBAO, No 1, 1981).. 26

ABSTRACTS

AERONAUTICS

HANGKONG ZHISHI [AEROSPACE KNOWLEDGE MAGAZINE], No 3, Mar 81............. 28

ARCHITECTURE

JIANZHU XUEBAO [ARCHITECTUAL JOURNAL], No 2, 20 Feb 81.................... 29

ARMAMENTS

BINGGONG XUEBAO [ACTA ARMAMENTARII], No 1, Feb 81......................... 33

CONSTRUCTION MACHINERY, EQUIPMENT

GONGCHENG JIXIE [CONSTRUCTION MACHINERY AND EQUIPMENT, No 1, 20 Jan 81.. 36

ELECTRONICS

DIANZIXUE TONGXUN [JOURNAL OF ELECTRONICS], No 1, 1981................... 39

DIANZI KEXUE JISHU [SCIENCE AND TECHNOLOGY OF ELECTRONICS], No 3 1981.. 45

ENGINEERING

HUAZHONG GONGXUEYUAN XUEBAO [JOURNAL OF HUAZHONG INSTITUTE OF TECHNOLOGY], No 4, 1980.. 47

HARBIN GONGYE DAXUE XUEBAO [JOURNAL OF HARBIN INSTITUTE OF TECHNOLOGY], No 4, Dec 80.. 61

MODERNIZATION

XIANDAIHUA [MODERNIZATION], No 2, Mar 81................................ 70

PHYSICS

BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTOR], No 1, 1981.......... 72

RADIO

WUXIANDIAN [RADIO], No 2, 11 Feb 81...................................... 77

SCIENTIFIC EXPERIMENT

KEXUE SHIYAN [SCIENTIFIC EXPERIMENT], No 3, 1981........................ 78

SHIPBUILDING

ZHONGGUO ZAOCHUAN [SHIPBUILDING OF CHINA], No 1, 1981.................. 80

APPLIED SCIENCES

CHINA'S FIRST SCIENTIFIC SATELLITE LAUNCHED

Beijing HANGKONG ZHISHI [AEROSPACE KNOWLEDGE MAGAZINE] in Chinese No 3, Mar 81 pp 2-3

[Article by Jiang Bin [3068 3430]: "The 'China-II' Satellite"]

[Text] On March 3, 1971, this country successfully launched its first scientific satellite. The satellite weighs 221 kg, has a perigee of 266 km, and an apogee of 1826 km. Its orbital period is 106 minutes, and the orbit inclination is 69.9 degrees. The satellite functioned normally and successfully completed its designated mission. On June 11, 1979, it fell back to earth in North America. This satellite remained in orbit for over 8 years; it provided valuable scientific data for designing future long-life satellites.

The "China-II" satellite is a multi-faced sphere with a diameter of 1 m. The satellite body is divided into two symmetrical upper and lower sections. Its middle section is a cylinder 150 mm in height. Its surface is made of 72 trapezoidal segments which are divided into three different patterns; there are 24 segments of each pattern symmetrically distributed around the mid section.

The top part of the satellite is a twelve-sided polygon surface which contains the VHF antenna. The bottom part of the satellite is a release ring approximately 200 mm in diameter; it is connected to the carrier vehicle.

Around the cylindrical mid section are four short-wave antennas placed at 90° apart to form a cross. To facilitate installation, the antennas are divided into 3 sections which are connected to each other with a telescopic arrangement just like the ones used on television sets or radios. During the launch phase, each antenna is in a folded position; after the satellite is placed into orbit, it is extended into open position by the spinning motion and the spring action.

Satellite Tracking

After the satellite is injected into orbit, it is spin-stabilized at a rate of 100 rpm. In order to determine the satellite motion, the satellite is tracked from the ground using both radio and optical sensors. To ensure reliable tracking of the "China-II" satellite, three tracking systems are used simultaneously; each system can independently determine the orbit.

A radio tracking sensor measures the satellite position using radio waves transmitted and received by a radar. For this reason, the satellite is equipped with a transponder which operates at a wavelength of 5 cm and a beacon which operates at a wavelength of 10 cm. The relatively small antennas for the transponder and the beacon are distributed evenly around the mid section. This is called a microwave tracking system. The beacon continually radiates 10-cm radio waves to be captured by the ground radar. Having detected the satellite, the ground radar transmits 5-cm radio waves to the satellite whereby the transponder responds with radio waves of the same wavelength. By transmitting and receiving radio waves of this type, the ground station can perform accurate measurements of the satellite orbit.

The VHF tracking system uses radio waves in the frequency range of 30 to 300 MHz (between 10 m and 1 m in wavelength). The "China-II" satellite has a beacon operating at a frequency of 202 MHz. It continually emits radio waves through the antenna located on top of the satellite. By receiving the radio waves at the ground radar, one can calculate the satellite orbit.

The optical tracking system requires a certain degree of brightness of the satellite. For this reason the exterior surface of "China-II" is highly polished. Under sunlight in a dark background, the satellite can be easily observed from the ground. Generally it is seen at dawn or dusk. On the basis of measured optical data, one can compute the satellite orbit.

Space Observations

The region of space referred to here is that part of space between the earth and the sun; in astronomy it is called the solar-terrestial space. The designated observations include high altitude atmospheric density, distribution of earth magnetic field, solar radiation characteristics, and cosmic rays. They are quite extensive and require long durations. Due to weight limitations, the only instruments carried by the "China-II" consist of a magnetometer, a solar X-ray detector, and a cosmic ray detector.

The earth magnetic field generally resembles that of a uniformly magnetized sphere. Its polarity is basically fixed; the two poles are located near the geographic south pole and north pole, they are called respectively the magnetic south pole and magnetic north pole. The region of influence of the earth magnetic field is quite extensive. Charged particles in space often move along or about the magnetic lines, forming two radiation belts above the equator. Knowledge about the magnetic field is useful in analyzing many physical phenomena and in measuring the attitudes of satellites or missiles. The magnetometer is designed to measure such distribution and variation.

Excessive amount of X-ray radiation absorbed by the human body may cause deterioration of the blood and may destroy exposed organs. X-rays can also cause damages to material structure and alter the properties of matter. The solar X-ray detector is used to observe the pattern of X-rays radiated from the sun in order to study astronomy and to provide guidelines for satellite design and manned space flight.

The cosmic ray detector is used to measure high energy particles from all sources, including cosmic rays from the sun and from galaxies. These high energy particles can react with matter and induce physical and chemical changes, thereby causing damages to human body and materials. Therefore it is extremely important to understand the laws of cosmic rays during activities in space.

Energy Sources

The power requirements of various equipment and instruments on "China-II" vary considerably in both magnitude and duration. Accordingly the satellite has two power supply systems: one is a silver-zinc battery, and the other is a cadmium-nickel battery with silicon solar cells. The former supplies power to equipment that require large power consumption and operate for a relatively short duration; the latter supplies power to equipment that require small power consumption operate for a long duration.

The energy content of the silver-zinc battery is limited and cannot be replenished. The silicon solar cells on the other hand can continually convert solar energy into electric energy; the only exception is when the satellite enters the earth shadow region, where sunlight cannot be received. To overcome this deficiency, the satellite is equipped with a cadmium-nickel battery. During the sunlit period, part of the electric energy generated by the solar cells is used to charge the cadmium-nickel battery so it can be used in the earth shadow region. The combined power supply from the silicon solar cells and the cadmium-nickel battery ensures continuous operation of the satellite instruments for an extended period.

The solar cells used on the "China-II" satellite are 1x2 cm^2 plates, connected in groups of 60 to form a composite solar panel located on the satellite surface. These are the deep-blue glass panels shown in the picture. The satellite has a total of 28 solar panels which are uniformly distributed over the satellite surface. Thus electricity is generated regardless of the direction of the solar rays.

Temperature Control

Generally speaking, the surface temperature of the satellite can reach over 100°C when it is in the sun; when it is in earth shadow, the temperature can drop down to 100°C below zero. The instruments inside the satellite cannot function normally under such drastic temperature variations. For this reason the surface skin of the

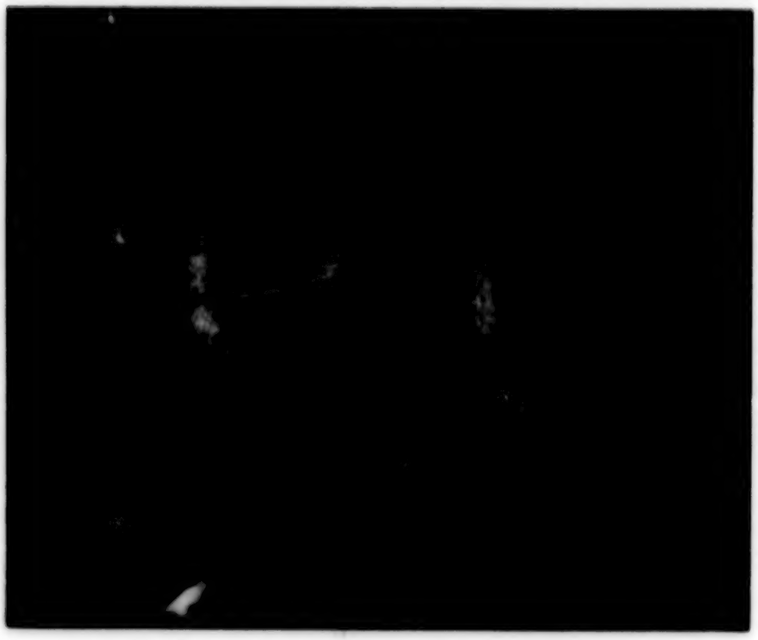
"China-II" satellite is polished to reduce the range of temperature variation.

There are also heat exchange problems inside the satellite. For example, the operation of cadmium-nickel battery and radio transmitter produces a large amount of heat which if not dissipated will raise the temperature to cause malfunctions. Other instruments such as the sun angle measuring device require heat input to maintain its operating temperature. In order to meet these requirements, various temperature control measures such as surface coating with paint or alloys, insulation, and the use of shutters have been taken to protect the instruments and equipment inside the "China-II" satellite.

The shutters are automatically controlled using bi-metallic strips. When the inside temperature is too high, the shutters are opened to increase heat dissipation; when the inside temperature is too low, they are closed to reduce heat dissipation.

Short Wave Telemetry

The data to be transmitted from the "China-II" satellite to the ground include not only contents of space observations but also the satellite attitude, temperatures at certain key locations of the satellite, and operating conditions of certain instruments. Some of these parameters must be monitored continuously, others require monitoring for a few weeks. Consequently, the "China-II" satellite has two different types of telemetry systems: one is a primary telemetry system designed to operate for a short period; the other is a secondary system designed to operate for an extended period. The former operates at a carrier frequency of 20.002 MHz, the latter operates at a carrier frequency of 19.996 MHz. Both telemetry signals are transmitted using the same short-wave antenna. Tests show that this method of transmission is quite feasible and the reliability of the carrier frequency is high.



China's Scientific Satellite--The China II

3012
CSO: 4008

APPLIED SCIENCES

DOUBLE CANARD AERODYNAMIC CONFIGURATION CHARACTERISTICS DETAILED

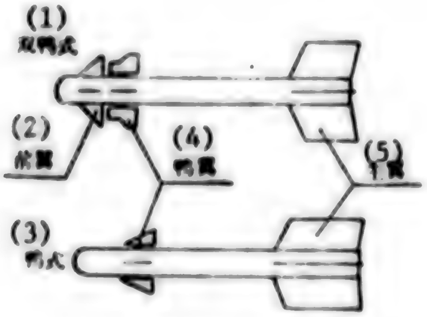
Beijing LIXUE YU SHIJIAN [MECHANICS AND PRACTICE] in Chinese Vol 2 No 2 May 80 pp 26-30

[Article by Wang Baoxing [3769 0202 5281] of the Tianjin Optical Instruments Plant: "Characteristics of the Double Canard Aerodynamic Configuration"]

[Text] The double canard aerodynamic configuration is a new type of configuration for air-to-air guided missiles. The Matra R550 close combat air-to-air missile successfully developed by France uses this type of aerodynamic configuration.

This article starts out from the basic mechanism of mutual interference between the forward fins and the canard fins to design the shape of the canard fins in the hope of obtaining a greater grain in lift. And more importantly, the characteristic of this type of aerodynamic configuration reveals that a favorable nonlinearity of the pitch moment in a small attack angle occurs. This article analyzes the characteristics of this type of "nonlinearity" in more detail and believes the double canard configuration is far superior to the canard configuration and it is an ideal configuration for the combat type air-to-air guided missiles.

Figure 1 shows the general configuration of the dynamic test model of the double canard and the canard aerodynamic configurations used in the test. The several lift surfaces have been standardized.



Key:
(1) double canard
(2) forward fin
(3) canard
(4) canard fin
(5) main wing

Figure 1. Names of Wing Surfaces

I. Design of the Canard Fin and Effect of the Gain in Lift

A comparison of the two types of aerodynamic configurations illustrated in Figure 1 clearly shows the double canard aerodynamic configuration consists of the installation of a forward fin in front of the canard fin of the canard aerodynamic configuration. The distance between the forward fin and the canard fin is very close. The mechanism of their mutual function is the same as that of the canard configuration[1,2] of a short distance and a small aspect ratio.

Previous studies have found that when the angle of attack of a large sweepback delta wing is very small, the air current separates at the leading edge, and an eddy at the leading edge that rotates at high speed is subsequently established to replace the separation disturbance. When the sweepback angle of the leading edge is sufficiently large, the eddy is very stable and within a very large angle of attack, the eddy enlarges as the angle of attack enlarges. The vortex core extends towards the inside upper part of the wing surface. Figure 2 (taken from reference (1)) gives the relationship among the position of the vortex core, the angle of attack α and the semi-vertex angle ε. At a far distance, the vortex core explodes, and in engineering terms, a "funnel" occurs. As the angle of attack enlarges, the "funnel" moves forward, and at a certain critical value α, it moves to the rear edge of the wing surface. Experiments show that when the vortex core reaches into the area of rising pressure, a "funnel" is easily formed. But when it extends into the area of dropping pressure, formation of the "funnel" is delayed.

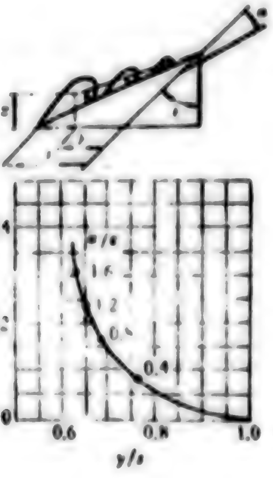


Figure 2. Relationship Between the Angle of Attack and the Position of the Leading Edge of the Vortex Core of the Delta Wing

The pressure inside the vortex core is very low because of the high speed of rotation of the air current. When the vortex core is on the wing surface, a kind of vortex core suction effect occurs. When the vortex core explodes on the wing surface and forms a "funnel," the original air current structure that was in order changes to a distribution of irregular vorticities, the pressure rises and thus the lift on the wing surface drops.

The two wing surfaces that are very close in distance (such as the forward fin and the canard fin in the double canard aerodynamic configuration) must mutually interfere. The effect of interference can be classified into two types according to their mutual positions: One type is that the leading edge eddy created by the forward fin passes by the upper part of the surface of the rear fin, i.e., through the area of reducing pressure over the rear fin. The vortex core becomes more stable. In addition, the velocity field induced by the leading edge eddy on the rear wing surface causes the leading edge eddy of the forward wing surface to move downward from the back part of the upper surface of the rear wing surface. The vortex core is even closer to the wing surface. Because of the suction effect of the vortex core, an added lift is created, and under the effect of the leading edge eddy of the forward wing, a very strong downwash is induced at the central part of the rear wing surface and a strong upwash is induced at the tip of the wing. The downwash at the center is the strongest at the tip of the wing surface, preventing formation of the leading edge eddy, but the upwash will hasten the formation of the leading edge eddy. As shown in Figure 3, because of the effect of the leading edge eddy of the forward wing, a leading edge eddy of the rear wing surface occurs at point A rather than at the vertex, and it is stronger than when it occurs separately. For the rear wing surface, the strong downwash at the central wing tip will have to sacrifice some angles of attack, and this is unfavorable. But because its leading edge eddy couples with the leading edge eddy of the forward wing surface and strengthens, and because two vortex cores pass through its upper surface, the vortex suction effect will create a very strong added lift, and the combined effect is very favorable. The other is that the leading edge eddy of the forward wing extends to the lower surface of the rear wing, i.e., extending into the area of rising pressure. At this time, the vortex core easily explodes earlier to form a "funnel" area. The "vortex suction effect" of the leading edge eddy of the forward wing will cause the lift of the rear wing surface to drop. This coupling effect is unfavorable and should be avoided.

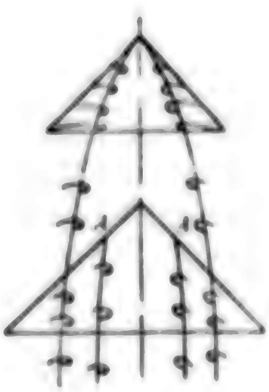
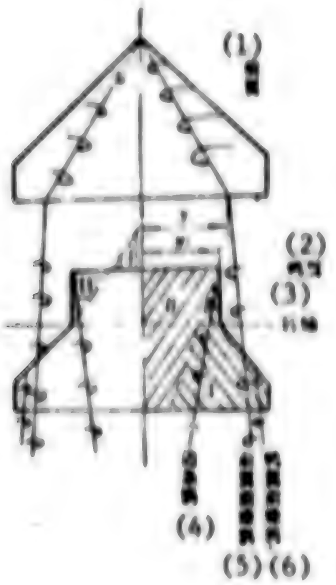


Figure 3. Effect of the Leading Edge Vortex of the Two Wing Surfaces That Are Close Together

The mutual function of the forward fin and the canard fin of the double canard aerodynamic configuration is to realize the first type of coupling described above. The leading edge eddy of the forward wing should pass over the upper surface of the canard fin to increase the lift of the canard fin. For this, the shape of the canard fin should be carefully designed. Figure 4 is the plane figures of the type of forward fin and canard fin used in the dynamic test model of the double canard aerodynamic configuration. This special case will be used in the following to explain the considerations in the design and the distribution of its vortices.



Key:

- (1) forward fin
- (2) canard fin
- (3) shaft
- (4) edge vortex
- (5) leading edge vortex of the forward fin
- (6) leading edge vortex of the canard fin

Figure 4. Illustration of the Vortices on the Forward Fin and the Canard Fin

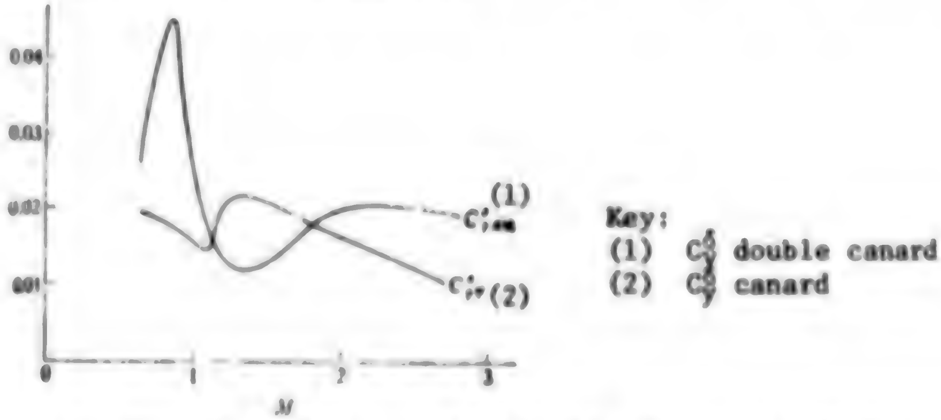
The short gap canard configuration of the aircraft discussed in References (1), (2) can realize coupling of the first type by designing the forward fin at a higher position than the rear fin. But for a guided missile, such coupling cannot be guaranteed simpy by the relative positions of the fins. The missile can rotate, and viewed from a certain direction, the forward fin is higher than the canard fin but it is the opposite after rotating 180°. The design shown in Figure 4 utilizes the exterior shape and the position of the shaft of the canard fin to assure such coupling. The canard fin is the controlling surface, and it must deflect. When it is deflected at an angle δ, the area in the back of the shaft will be lower than the forward fin. If the position of the vortex core of the leading edge vortex of the forward fin trailing from the fin's surface is $Y > Y_1$ (refer to Figure 4), it can then be assured that the leading edge eddy of the forward fin will pass over the upper surface of the canard fin, thus creating a favorable coupling effect. It can be seen from Figure 2 that Y is related to the semi-vertex angle ε of the forward fin and the angle of attack α. Y_{min} corresponds to α_{max}, and to assure that the leading edge vortex of the forward fin always passes over the upper surface of the canard fin within all the angles of attack, we must have $Y_{min} > Y_1$.

It has been pointed out previously that the function of the leading edge vortex of the forward fin causes the area of part I shown in Figure 4 to bear a strong downwash, and the lift created at this part is smaller. In the design, the area of this part is eliminated and moved to part II. The part in front of the shaft forms a rectangle. A side strip vortex on the side of the rectangular part is created. In this way, three vortices exist on the upper surface of the canard fin: the side strip vortex, the leading edge vortex of the forward fin and the leading edge vortex of the canard fin. They couple with each other and strengthen each other. Because of the "vortex core suction effect," the lift of the canard fin increases to a greater extent than that of the canard fin of the canard configuration. Table 1 shows the lift coefficient of the canard fin as a partial derivative of the angle of attack obtained in the wind tunnel experiment of the double canard dynamic test model (without the main wing) and the lift coefficient of the canard fin of the canard configuration (the same missile body, the same canard fin, without the forward wing) as a partial derivative of the angle of attack. The values are all listed within the range of $\alpha = \pm 2°$. The angle of yaw is $\delta = 20°$, i.e., $\alpha + \delta = 20° \pm 2°$. The data in the table show that when the angle of attack is large, ($\alpha + \delta$ is the angle of attack of the canard fin) the side vortex and the leading edge vortex of the forward fin and the leading edge vortex of the canard fin all increase and the gain in lift is very visible.

Table 1.

M	0.60	0.70	0.80	0.90	1.00	1.10
Canard	0.0308	0.0205	0.0274	0.0285	0.0313	0.0513
Double canard	0.0462	0.0493	0.0557	0.0479	0.0544	0.0698

Figure 5 shows the lift coefficients of the entire missile as partial derivatives of the angle of yaw δ obtained from the wind tunnel experiment of the double canard and canard dynamic test models. The C_y^δ approximates the lift coefficient of the canard fin as a partial derivative of the angle of attack. To facilitate comparison, the reference areas of C_y^δ have all been taken as the areas of the canard fin (cantilever segment). The curve in Figure 5 shows that when 0.6 M < 1.1 and when M > 1.8, C_y^δ double canard >> C_y^δ canard. This further proves the effect of the gain in lift of the canard fin in the double canard aerodynamic configuration.



Key:
(1) C_y^δ double canard
(2) C_y^δ canard

Figure 5. Experimental Curve of C_y^δ Double Canard and C_y^δ Canard

II. "Nonlinear" Effect of the Double Canard Aerodynamic Configuration

If the increase in the lift of the canard fin as a result of adding a forward fin in front of the canard fin in the canard aerodynamic configuration is the expected effect of the double canard aerodynamic configuration, then the results of wind tunnel experiments show another important and unexpected characteristic--the pitch moment M_z shows a favorable nonlinearity in a small angle of attack. Figure 6 shows the curve of the typical M_z - α wind tunnel experiment of the dynamic test model of the double canard aerodynamic exterior. At a small angle of attack on the curve (AA' and LL' segments), M_z increases as the angle of attack α enlarges ($M_z^\alpha > 0$). Mz becomes smaller as the angle of attack α enlarges ($M_z^\alpha < 0$) only after point A' (or point L'). This type of "nonlinearity" has the following superior characteristics (refer to Figure 6):

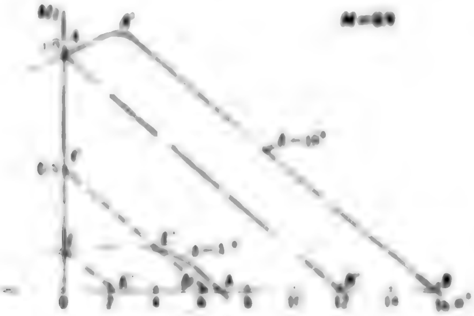


Figure 6. The Curve of the Moment of Pitch of the Double Canard Aerodynamic Configuration

(1) Under the same static stability, a greater angle of attack can be obtained than in the canard aerodynamic configuration, thus a greater transverse transient load can be obtained. Point A is the pitch moment created by a deflection of 18° of the canard fin (α = 0°). The equilibrium point of the double aerodynamic configuration ($M_z = 0$) is B, and the $\alpha_{\text{balanced double canard}} = 16°$. In the canard configuration, the M_z at the starting point $M_z(\delta = 18°, \alpha = 0°)$ and the equilibrium point are the same as that of the double canard configuration because its M_z - α curve is linear and the equilibrium point is B'. From Figure 6 we obtain

$$\alpha_{\text{balanced}\cdot\text{canard}} \doteq 12°$$

therefore,

$$\Delta\alpha = \alpha_{\text{balanced}\cdot\text{double canard}} - \alpha_{\text{balanced}\cdot\text{canard}} \doteq 4°$$

This shows that when M = 0.9 and the deflection of the canard fin is 18°, an equal pitch moment is created, and under the same static stability (M_z^α is the same), because of the nonlinearity of the M_z - α curve of the double canard aerodynamic configuration, it creates an equilibrium angle of attack 4° larger than that of the canard configuration, equivalent to an increase of one-fourth in the transverse transient load.

If the areas of the canard fins are the same and if the higher efficiency of the canard fins in the double canard aerodynamic configuration is considered (From Figure 5 we find that when M = 0.9, C_y^δ double canard $\doteq$ 2 C_y^δ canard), at the same deflection of 18°, we have

$$M_{z\ \text{canard}}\ (\alpha = 0,\ \delta = 18°) \doteq \frac{1}{2} M_{z\ \text{double canard}}\ (\alpha = 0,\ \delta = 18°)$$

The starting point of the canard configuration is at C. If the same M_z^α is maintained at the place of equilibrium, the equilibrium point is at D, $\alpha_{\text{balanced canard}} \doteq 6°$.

$$\Delta\alpha = \alpha_{\text{balanced}\cdot\text{double canard}} - \alpha_{\text{balanced.canard}} \doteq 10°$$

The maximum usable transient load

$$n_{\max} = (C_y^\alpha \cdot \alpha_{\text{balanced}} + C_y^\delta \cdot \delta_{\max}) \frac{q \cdot s}{w}$$

where: C_y^α -- the lift coefficient of the guided missile as a partial derivative of the angle of attack α; C_y^δ -- the lift coefficient of the guided missile as a partial derivative of the angle of yaw δ; $\delta_{\max}$ -- maximum angle of yaw; $\alpha_{\text{equilibrium}}$ -- equilibrium angle of attack under the maximum angle of yaw; q -- aerodynamic pressure; s -- reference surface; w -- weight of missile.

Considering $C_y^\alpha \cdot \alpha_{\text{balanced}} \gg C_y^\delta \cdot \delta_{\max}$, it can be approximately believed that the maximum usable transient load is directly proportional to the maximum equilibrium angle of attack. This means, when the area of the canard fins is the same, at the same deflection of 18° and when the same static stability is maintained, the equilibrium angle of attack of the double canard aerodynamic configuration is larger than the equilibrium angle of attack of the canard aerodynamic configuration by 10°, the transverse usable transient load increases by nearly 1.6 times.

(2) The dynamic response velocity is higher than that of the canard configuration. When the deflection of the canard fin is 3°, the pitch moment M_z ($\alpha = 0$, $\delta = 3°$) is produced, i.e., point L in Figure 6. The angle of attack begins to enlarge and finally reaches the static equilibrium point K. The pitch moment of the double canard aerodynamic configuration varies along the solid line LL' to point K. Within the LL' segment, as α enlarges, M_z also increases, thus hastening the rate of enlargement of the angle of attack. After passing point L', as the angle of attack enlarges, M_z lessens. At point K, M_z^α is negative, thus K is a statically stable point. In the canard configuration, when the equilibrium point M_z^α is the same, then the pitch moment varies from point L along a straight line to point K'. In this way, α enlarges and M_z drops linearly, and the rate of enlargement of the angle of attack also drops. It can thus be seen that the dynamic response velocity of the double canard aerodynamic configuration is much faster than that of the canard aerodynamic configuration.

Figure 7. Illustration of the Forces Upon the Various Parts of the Double Canard Guided Missile

Key: (1) Y_{head} (3) Y_{canard}
(2) $Y_{forward\ fin}$ (4) $Y_{main\ wing}$

This kind of nonlinearity is caused by the addition of the forward fin. Figure 7 shows the forces acting upon each part of the double canard guided missile. From the figure we obtain

$$M_z = Y_{head}\, X_1 \sin\alpha + Y_{forward\ fin}\, X_2 \sin\alpha + Y_{canard}\, X_3 \sin(\alpha - \varepsilon_1) - Y_{main\ wing}\, X_4 \sin(\alpha - \varepsilon_2)$$

where: Y_{head} -- the lift at the head; $Y_{forward\ fin}$ -- lift at the forward fin; Y_{canard} -- lift of the canard fin; X_1 -- distance of Y_{head} from the center of gravity; X_2 -- distance of the $Y_{forward\ fin}$ to the center of gravity; X_3 -- distance of the Y_{canard} to the center of gravity; X_4 -- distance of the $Y_{main\ wing}$ to the center of gravity; ε_1 -- the average downwash angle at the canard fin; ε_2 -- the average downwash angle at the main wing.

When α is small, $\sin\alpha \doteq \alpha$, the above equation can be rewritten as

$$M_z = [C_y^\alpha{}_{head}\, S_{head}\, X_1 \alpha^2 + C_y^\alpha{}_{forward\ fin} \cdot S_{forward\ fin}\, X_2 \alpha^2 + C_y^\alpha{}_{canard}\, S_{canard}\, X_3\, (\alpha-\varepsilon_1)(\alpha+\delta-\varepsilon_1) - C_y^\alpha{}_{main\ wing}\, S_{main\ wing}\, X_4\, (\alpha-\varepsilon_2)^2]q$$

where q is the dynamic pressure.

When α is small, C_y^α is neglected, X varies with α, thus we have

$$M_z^\alpha \doteq [2C_y^\alpha{}_{head} \cdot S_{head}\, X_1 \alpha + 2C_y^\alpha{}_{forward\ fin} \cdot S_{forward\ fin}\, X_2 \alpha + 2C_y^\alpha{}_{canard} \cdot S_{canard}\, X_3 (\alpha+\delta/2 - \varepsilon_1) - 2C_y^\alpha{}_{main\ wing}\, S_{main\ wing}\, X_4 (\alpha-\varepsilon_2)]q$$

When δ = constant, ($S_{\text{forward fin}} + S_{\text{canard}}$) is not smaller than $S_{\text{main wing}}$ by too much, (such as the dynamic test model of the double canard aerodynamic configuration shown in Figure 1, $S_{\text{forward fin}} + S_{\text{canard}} = 0.8\ S_{\text{main wing}}$) and near a small α, $(\alpha + \delta/2 - \varepsilon_1) \gg (\alpha - \varepsilon_2)$, then $M_z^{\alpha} > 0$.

When α is larger, $(\alpha + \delta/2 - \varepsilon_1)$ and $(\alpha - \varepsilon_2)$ are not too different, $S_{\text{main wing}}X_4$ is larger, the last term of the above equation exerts the major effect, thus $M_z^{\alpha} < 0$. This is the cause of nonlinearity. Because the area of the canard fin in the canard aerodynamic configuration is small, the lift of the main wing always exerts the main effect. Therefore M_z^{α} is always smaller than zero.

III. Control Characteristics of the Double Canard Aerodynamic Configuration

As pointed out earlier, the efficiency (C_y^{δ}) of the canard fin is increased by suitably designing the position of the shaft and the shape of the canard fin in the double canard configuration. Another demand upon the control surface is that the moment of the hinge is small. Only in this way can the servo mechanism satisfy the characteristics required and at the same time be not too heavy and not too large. Everyone knows that the key to reducing the moment of the hinge is to reduce the amount of variation of the center of pressure of the canard fin under various states. For example, like the canard control, the canard fin is a delta wing (as shown in Figure 8). The subsonic pressure center is between the mean aerodynamic chords of 0.3 and 0.4. At supersonic speeds, it approaches the mean aerodynamic chord of 0.5. Stability of control requires that the shaft of the canard fin be situated in front of the pressure center. The maximum moment of hinge is (See Figure 8)

$$M_{\text{hinge}} = -Ph_2 = -Ph_1 - P(h_2 - h_1)$$

where: M_{hinge} -- the maximum moment of hinge; P -- the maximum perpendicular component force on the surface of the canard fin; h_1 -- the smallest distance from the center of pressure at subsonic speeds to the shaft; h_2 -- the greatest distance from the center of pressure at supersonic speeds to the shaft.

If the shift of the maximum pressure center $h_2 - h_1$ is very small, then as long as h_1 is designed to be sufficiently small, the moment of hinge can be reduced. The shift of the pressure center of the canard control is about 0.2 mean aerodynamic chord length, thus it is very difficult to make the moment of hinge too small.

The position of the center of pressure of the canard fin of the double canard aerodynamic configuration does not vary much with velocity. Stability can also be explained in this way. In the area A of the canard fin (Refer to Figure 4), there are the effects of the leading edge vortex of the forward fin, the side strip vortex of the canard fin and the leading edge vortex of the canard fin on the upper surface. The suction effect of the vortex core increases the lift in that area. In addition, it is situated in the upwash area of the on-coming flow. The angle of attack also enlarges, thus the contribution of area A to

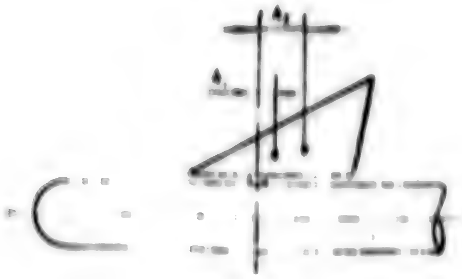


Figure 8. Controlled Moment of Hinge

the lift of the entire canard fin is large. Area B does not have vortex suction and it is situated in the downwash area of the on-coming flow. Its contribution to the lift of the canard fin is small. The combined effect of area A and area B causes the subsonic pressure center to approach 0.5 mean aerodynamic chord length, and at supersonic speeds, it approaches 0.5 mean aerodynamic chord length even more. This shows that the pressure center of the canard fin of the double canard aerodynamic configuration varies very slightly with the Mach number. It is very difficult to use computational methods to accurately obtain the position of its pressure center. It must be determined with the aid of the wind tunnel experiment. If the exterior shape of the canard fin illustrated in Figure 4 is suitably designed, the variation in the position X of the center of pressure is

$$0.45b_{AK} < X < 0.5b_{AK}$$

In the above, X is the distance from the starting point of the mean aerodynamic chord to the center of pressure, b_{AK} is the mean aerodynamic chord length of the cantilever segment. The maximum variation of the center of pressure with the velocity is $h_2 - h_1 \doteq 0.05b_{AK}$, 1/4 that of the canard aerodynamic configuration. If the shaft is designed at the $0.43b_{AK}$ position, then

$$M_{\text{hinge double canard}} \doteq 0.07\ Pb_{AK}$$

$$M_{\text{hinge canard}} \doteq 0.22\ Pb_{AK}$$

When the aerodynamic force P is the same, the moment of hinge of the double canard configuration is only 1/3 that of the canard configuration.

In summary, when S/W is the same, a greater mobility and a faster dynamic response velocity can be obtained with the double canard aerodynamic configuration than with the canard configuration, and the power of the rudder engine required is smaller, therefore it is a type of ideal aerodynamic configuration for the combat air-to-air guided missile. The low altitude surface to air guided missile that requires greater mobility can also use this kind of configuration.

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9296
CSO: 4008

APPLIED SCIENCES

REMOTE CONTROL AIRPLANES USED IN AERIAL PHOTOGRAPHY

Beijing GUANGMING RIBAO in Chinese 23 Mar 81 p 2

[Article by reporter Liu Bingqi [0491 3521 3823] :"Experimental Remote-Control Aircraft To Conduct Aerial Photography and Geophysical Prospecting"]

[Text] A remote-control aerial magnetic measuring system was recently developed by the Shansi Geological Bureau and the Northwest Industrial College. The system is carried by a small pilotless airplane to conduct aerial photography and geological exploration. This is an important achievement by the Chinese scientists to apply remote-control airplanes in civil affairs.

On 13 January, delegates from all over the country gathered near the south suburb of Xian to observe two remote-control airplanes perform aerial photography and magnetic measurements. The remote-control airplane was boosted onto the air by rockets and went through a number of maneuvers before entering into a designated flight path. Under the remote control of a positional navigation system on the ground, it automatically took aerial pictures and magnetic measurements, and reliably transmitted the data back to the ground. After the experimental mission, the airplane returned to a designated position where the engine was shut off and a parachute opened; the airplane was safely brought back to ground.

Although this country has had experience in aerial survey activities for a number of years, detailed inspection of scattered and small areas has been a difficult task for conventional piloted airplanes. A small remote-control airplane is more economical and easier to maneuver; it compliments the large airplane in aerial survey work. Compared to ground-based survey work, it requires much less manual labor and thus increases efficiency. This provides a new approach for geological exploration and survey; it also opens a new path for the application of remote-control airplanes in agriculture, forestry, coal mining, urban development, hydro-electricity, railroad, and environmental protection.

"Experimental application of remote-control airplanes in aerial photography and geophysical prospecting" is a major goal in national scientific research. Over 100 engineers, professors, and technicians have devoted their best efforts to this goal for more than 6 years. They have overcome numerous difficulties and completed four major tasks including "remote-control airplane modification" and "positional navigation testing", etc. They have published technical reports on 21 special topics; some of the results were reported for the first time in this country. The innovative ability of the research workers allowed them to use all Chinese products in the development and assembly of many sophisticated equipment. They also conducted over 130 flight tests, and accumulated a large amount of information on remote-control measurement technology as well as experimental data for designing the next generation remote-control airplane dedicated for geological application.

3012
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APPLIED SCIENCES

ULTRASONIC FUEL EMULSIFYING TECHNIQUE USED IN STEEL REFINING

Beijing GUANGMING RIBAO in Chinese 19 Nov 80 p 1

[Article: "Our Country's First Experiment in Use of an Emulsion of Open-Hearth Furnace Fuel Oil With Water in Steel Refining Succeeds"]

[Text] Research personnel of Laboratory No 8 of the Institute of Acoustics, Chinese Academy of Sciences, together with the Tianjin No 1 Steel Mill and other units, have developed a fuel in which fuel oil is emulsified with water. Appraisal indicates that when the fuel oil is mixed with 7 to 8 percent of water, a saving of 6.5 to 9 percent on fuel oil can be realized.

This method of conserving fuel oil cannot be implemented simply by adding water to the oil and burning it. The process involves use of a special suspended-arm reed-whistle ultrasonic generator to eject the oil-water mixture through a narrow slit in the emulsifier nozzle so that strong resonance occurs between the vibrating sheet of liquid ejected and the reed in front of the nozzle; this produces cavitation explosions in the liquid, with the result that the water in the oil is broken up into small droplets, 90 percent of which are of a fineness equal to 1/40 to 1/15 the thickness of a human hair. These droplets are suspended in the oil and form a water-in-oil emulsion. It is generally thought that when an emulsified liquid is sprayed through the burner nozzle, forming a mist which enters the furnace chamber, the droplets of this water-in-oil emulsion turn to steam and produce small explosions, so that the oil droplets are broken down into still finer form (which is generally called secondary atomization). This makes the fuel oil burn better, so that thermal energy is increased and oil is saved. At the same time, burning oil in this way makes it possible to decrease smoke and ash and alleviate environmental pollution.

In order to study the effect of the ultrasonic emulsifier, 4 years ago the research personnel of Laboratory No 8 of the Institute of Acoustics went to the Tianjin No 1 Steel Mill and worked with its leadership cadres, technical personnel and master workers to improve the emulsifier and the emulsification process and to find better oil-water emulsification and combustion states, putting in painstaking labor on the problem. Ultrasonics expert Professor Ying Chongfu [2019 1504 4395] and institute chief Professor Wang Dezhao [3076 1795 2507] frequently visited Laboratory No 8 to direct its work, and concerned themselves with the progress of the experiments.

After work was begun on this topic, a number of the cooperating units conducted several years of tests on the Tianjin No 1 Steel Mill's open hearth furnace. The entire experiment was divided into three stages: the initial stage of studying designs and processes for the emulsification equipment and investigating the oil conservation effect; the critical stage of improving the quality of emulsification and combustion and making heat engineering measurements; and the relatively long trial production stage. Experience showed that when the emulsified oil was burned in the furnace, it was necessary to decrease the amount of air used; when it was decreased by 11.5 percent, the flame temperature could be increased by about 20° C, and the quality of the steel produced met standards. The ultrasonic emulsifier is not only inexpensive to manufacture, but is efficiently designed, convenient to operate and easy to maintain, and has high productivity.

On 7-8 November, the Ministry of Metallurgy had the Tianjin Municipal Office of the Metallurgical Industry hold a technical assessment meeting in Tianjin, to which 50 persons including specialists, professors and representatives of such leadership organs as the State Scientific and Technical Committee, the Planning Committee, the Economic Committee and the Office of Material Resources were invited, to carry out ministry-level assessment of this oil-saving technology. The specialists stated that at present our country burns mostly heavy oil and crude oil, and if this development could be quickly put into extensive use large quantities of fuel oil could be conserved.

8480
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RESEARCH ON TECTONIC FRAMEWORK OF BEIJING DISTRICT

Beijing GUANGMING RIBAO in Chinese 19 Feb 81 p 1

[Article: "Beijing Institute of Seismogeology Achieves Fruitful Results"]

[Text] According to reports by Sun Yue [1327 1878], a trainee in journalism, and Sun Guanlong [1327 7070 7893], a journalist, through the coordinative and painstaking efforts of almost 4,000 scientific and technical personnel, the 4-year-old Beijing Institute of Seismogeology has attained remarkable achievements.

The seismogeological research project was initiated in the wake of the Tangshan earthquake. Participants included the Beijing Geological Bureau, and 52 central and local level scientific research institutes, educational institutions and production organizations, involving nearly 20 branches of learning and over 30 types of work, using more than 10 different methods, such as aeromagnetic survey, satellite picture analysis, laser ranging, magnetotelluric depth probing, artificial seismic and natural seismic converted waves, etc. They conducted numerous field surveys, simulation experiments, data checking, and comprehensive study. As the result of the research efforts, the framework of Beijing District's geologic structure 30-50 km below the surface has been revealed for the first time; there are new discoveries of some major fault structures and preliminary findings on the characteristics of the tectonic activities in this area since the beginning of man. The first-ever "Beijing District Tectonic System Chart" and "Beijing District Active Tectonic System Chart" of 1:100,000 have also been produced. Moreover, they have thoroughly investigated the area's center of descendent and its extent of influence. Sea facies fossils of the Early Quarternary Period have been unearthed in this area for the first time, which verifies that the area was just a vast expanse of sea water 3 million years ago, thus providing a new basis for proving that the area has undergone crustal uplift and neotectonic movement. On the basis of the research on the relationship between seismic activity and geological structure, they have also presented some preliminary ideas on the trend of seismic activity within the next decade.

Over the past 4 years, they have achieved numerous results in individual projects and presented more than 70 scientific reports and academic papers, including nearly 20 articles published in "Scientia Sinica." Five scientific research projects were awarded scientific research achievement prizes by the Beijing Municipality and the Chinese Academy of Sciences. Some of the results were presented in international academic symposiums and were well received. Of course, there are quite a number of projects and achievements which are very preliminary, and still require tremendous amount of work. At a recent conference attended by prominent seismic geology experts, professors and scientific workers who were involved in the research, everyone shared the feeling that this was the first time China has ever undertaken research on such a large scale, involving such a wide range of science disciplines, and so many different types of work, using every available means of experimentation, and achieving such remarkable results.

9119
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SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

UNIQUE ACHIEVEMENTS OF LANZHOU DESERTIFICATION INSTITUTE

Beijing GUANGMING RIBAO in Chinese 19 Feb 81 p 1

[Article by Wang Lichao [3769 4539 2600]: "China Achieves Unique Developments in Desertification Research"]

[Text] Over the past 3 years, the Lanzhou Institute of Deserts of the Chinese Academy of Sciences has been conducting scientific field surveys in arid and semi-arid desertified areas in Nei Monggol's Yih Ju League, the southern portion of Ningxia and the northern part of Shaanxi. Through persistent efforts, they have achieved new developments in the study of the classification and regionalization of desertification as well as proper utilization [of natural resources in desert areas] and ways of prevention [of desertification], the results of which are quite unique as compared with similar work in other countries.

Desertification is a worldwide problem. At present, approximately one-third of the entire globe's land area is either struck or threatened by desertification. On the average, 50,000-70,000 square km of land is threatened by desertification each year. In the northeastern, northern and northwestern parts of our country, desertification has already struck 207 counties (towns and leagues) in 11 provinces (municipalities and prefectures), gravely affecting industrial and agricultural production as well as telecommunications and the very livelihood of the people in these areas.

Over the past 3 years, the Lanzhou Institute of Deserts organized scientific and technical personnel specializing in more than 10 different fields, such as wind-drift sand geomorphology, soil hydrology, agroforestry, remote sensing, etc., and sent them to Yih Ju League, southern Ningxia, northern Shaanxi, Talimu Basin, where they conducted scientific field surveys and research in extremely hot, windy, sandy conditions, overcoming one difficulty after another. The survey teams in southern Ningxia, northern Shaanxi and Yih Ju League regions traveled almost 100,000 km, covering 188,000 square km. They gathered large amounts of soil and ground water samples as well as vegetation specimens, and obtained first-hand information. Through the surveys, they have come up with initial findings of the extent, history and current status of desertification in the three northern regions. Moreover, they have proposed plans for the proper utilization of the natural resources in the desert areas and ways of preventing desertification in the three northern regions. In addition, instead of using traditional knowledge and methods to deal with soil salinization, i.e., digging water drainage ditches, they have proposed such biological measures as afforestation and planting grass. On the basis of the field surveys, the institute has presented a new summarization and classification of current world concepts on desertification.

9119
CSO: 4008

PUBLICATIONS

TABLE OF CONTENTS OF 'FEIJINSHU KUANG,' NOVEMBER 1980

Beijing FEIJINSHU KUANG [NONMETALLIC ORES] in Chinese No 4, 28 Nov 80 inside front cover

[Text] Table of Contents

Reforming Quality Standards and Improving Product Quality Are an Important Link in Developing the Asbestos Industry--Zhao Jingqi [6392 2529 3825] .... (1)

Development of Disc-Shaped Composition Brake Linings for High Speed Passenger Trains--Wang Yanxiao [3769 1693 1321], Hangzhou Brake Materials Plant .... (2)

Steel Cable Tension Equilibrium in Multicable Tension Wheel Hoisting--Zhang Shipei [1728 0013 1014], Suzhou Nonmetallic Ore Mine Design Institute, Ministry of Construction Materials .... (5)

Mechanization of the Cage Loading and Emptying Line at the Shaft Head of a Vertical Shaft in the Yincheng Gypsum Mine--Ding Zhiren [0002 1807 0088], Yingcheng Gypsum Mine .... (12)

Experimental Use of Mathematical Geology To Determine a Rational Prospecting Network for the Yingcheng Gypsum Mine Area--Bai Shouchang [4101 1108 2490], Hubei Nonmetallic Minerals Geology Corporation .... (17)

Principles of Shaping of Colored Terrazzo Products and an Investigation of Factors Affecting Product Quality--Wang Liyan [3769 4539 1484], Shenyang Marble Quarry .... (24)

Determining the Tunneling Rate in Mica Mines--Li Huisen [2621 1920 2773], Mica Mine No 3, Xinjiang Nonmetallic Minerals Corporation .... (28)

The Mohr Theory of Strength and Its
Applications in Mining Engineering--
Lu Xueqing [0712 1331 3237], Wuhan
Building Materials Industry Academy.................................... (32)

Letters From Readers

Management of Marble and Other Nonmetallic
Mineral Resources Should Be Strengthened--
Zhao Peiliang [6392 3099 5328],
Northeast China Building Design Institute............................... (37)

Small-Scale Reforms

Remote Operation of Electric Vehicles in
the Ore Loading Area--
Technical Department, Jinzhou Asbestos Mine............................. (38)

Measures for Saving Oil in Air Compressors--
Song Yubao [1345 3768 0202], Jinzhou Asbestos Mine...................... (39)

Foreign Literature

Foreign Literature and Patent Abstracts................................. (40)

A Friction Material That Does Not Produce Braking Noise................. (42)

Air Classification of Long-Fiber Textile Grade Asbestos................. (43)

Japanese Sodium Bentonite... (45)

A Way of Strengthening the Process for Preparation
of Starting Materials for Asbestos Products............................. (48)

A Survey of Foreign Research on Organic Binders
for Asbestos Friction Materials... (51)

Application of High Energy Rays to Brake Shoes.......................... (63)

A Large Cylindrical-Winding Magnetic Ore Classifier..................... (64)

Brief Notices of New Books

The Friction Physics, Chemistry, and Dynamics of
Asbestos Friction Materials and Their Evaluation........................ (64)

Concise Data

The Origin of the Carat... (65)
Foreign Kaolin Output... (50)

8480
CSO: 4008

PUBLICATIONS

TABLE OF CONTENTS OF 'GUTI LIXUE XUEBAO' NO 1, 1981

Hubei GUTI LIXUE XUEBAO [ACTA MECHANICA SOLIDA SINICA] in Chinese No 1, 1981 pp i-ii

[Text] Dynamic Analysis of Steel Struts Subjected to Impulsive Loading with Linear Attenuation......Li Guohao [2621 0948 6275], Wang Yuangong [3769 6678 0501] and Zhou Zhengwei [0719 2973 1218] (1)

A Homologous Optimization Design of Large Antenna Structure ......Wang Shenghong [3769 3932 3163], Li Zhiliang [2621 1807 5328] and Wang Qinque [3076 0534 1952], et al. (12)

A Stiffness Matrix of Rectangular Element for Plates Including Transverse Shear Deformation......He Dazhuo [6320 1129 2154] (27)

Suggestions on the Application of the Finite Element Method with Examples of Plane Stress Problems in Elasticity...... Hu Haichang [5170 3189 2490] (39)

Analysis of Variation of the Coefficient of Subgrade Rigidity in Soil with Depth......Pan Fulan [3382 1788 5695] (48)

Elastoplastic Constitutive Relations of Progressive Failure for Rocklike Media......Yin Youquan [3009 2589 3123] (58)

On the Problems of Sandwich Plates with Surface Layers of Non-equal Thicknessus......Xue Dawei [5641 1129 3634] (65)

A Rigorous Proof of the Formula for the Released Energy of a Crack of Arbitrary Shape......Hao Tianhu [6787 1131 6233] (72)

Experimental Research and Techniques

Multiaperture White Light Speckle Method Applied to the Strain Analysis of Cylinders with Hotes under Compression......Jiang Fuben [1203 1788 2609], Liu Baochen [0491 1405 3819] and Lin Shutian [5677 2579 3944] (78)

Experimental Investigation on the Plastic Stability of a Cylindrical Shell under Axial Compression......Shen Li [3088 4539] and Han Mingbao [7281 6900 1405] (85)

Statistical Treatment of K_{IC} Test Data......Liu Wenting [0491 2429 3806] (92)

Research Notes

Computation of K_I and Compliance of Arch-shaped Specimen by the Infinite Similar Element Method......Ying Longan [2019 7127 1344] and Pan Hao [3382 3493] (99)

Suggestion of a Generalized Variational Principle for Limit Analysis......Jin Fusheng [6855 0126 3932] (107)

Some Calculations of SIF K_{III} for Cracks in Torsional Bars with Angle Sections and Their Torsional Rigidity......Chen Yizhou [7115 1355 0719] (110)

The Moment Coefficients of Elastic Fixed End for Beams and Beams on Elastic Foundation......Lin Yantian [2651 4291 3944] (117)

Review or Outlook

Brief Comments on the Development of Cosserat's Continuum Theory......Dai Tianmin [2071 1131 3046] (123)

9717
CSO: 4008

AUTHOR: JIANG Bin [3068 2430]

ORG: None

TITLE: "The 'China-II' Satellite"

SOURCE: Beijing HANGKONG ZHISHI [AEROSPACE KNOWLEDGE MAGAZINE] in Chinese No 3 Mar 81 pp 2-3

ABSTRACT: The "China-II" satellite was the first scientific satellite launched by China on March 3, 1971. It remained in orbit for over eight years, during which time a number of important experiments were carried out. Its orbit was determined using three independent tracking systems including both radars and optical sensors. The scientific missions of the "China-II" satellite included measurements of high altitude atmospheric density, distribution of the earth magnetic field, solar radiation characteristics, and cosmic rays. The power supplies of the satellite consisted of a silver-zinc battery and a cadmium-nickel battery with silicon solar cells. The satellite is covered with reflective coating and equipped with temperature control devices to minimize temperature variations inside the satellite. To transmit data back to the ground, the satellite has two telemetry systems: a short term telemetry system operating at a carrier frequency of 20.002 MHz, and a long term telemetry system operating at a carrier frequency of 19.996 MHz.

AUTHOR: KO Bing [4430 0365]

ORG: None

TITLE: "The Side Looking Radar On the U-2 Airplane"

SOURCE: Beijing HANGKONG ZHISHI [AEROSPACE KNOWLEDGE MAGAZINE] in Chinese No 3 Mar 81 p 15

ABSTRACT: The new U-2 reconnaissance airplane, model TR-1, is equipped with a side looking radar which has two synthetic aperture antennas on each side of the airplane. When the airplane is in motion, the synthetic aperture antenna has an effective aperture size of several thousand meters and therefore greatly enhances the resolution capability of the radar. The side looking radar can be operated either in the broad area search mode or in the detailed inspection mode. It can produce images with resolution less than 3 meters and with picture quality comparable to those produced by optical sensors. Furthermore, the radar system has an automatic fault detection and fault location capability; it can also detect targets under all weather conditions and transmit measured data to a ground control station for real-time processing.

3012
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AUTHOR: JIN Oubu [6855 3917 0592]

ORG: None

TITLE: "Problems in the Urban Structure of Beijing"

SOURCE: Beijing JIANZHU XUEBAO [ARCHITECTURAL JOURNAL] in Chinese No 2, 20 Feb 81 pp 1-7

TEXT OF ENGLISH ABSTRACT: 1. The Character of the City.
After a review of the development of Beijing in the past 30 years, the author points out that the crucial problem in the development of the city should be the recognition of its peculiar character. Based on the objective conditions and its particular position as the capital, the author proposes that the character of the political center of the country should be emphasized around which developments along all other lines should be subordinated.
2. The Scope and Lay-out of the City.
The author states that the population of the municipality by the end of the century should be controlled within 10 million, and that of the urban area within 6.5 million. The urban area should be extended from 340 sq km to 440 sq km. Enterprises causing over-population should be dispersed to the outer suburbs. Small towns in the counties should be vigorously developed to reduce the population density of the urban area. The relationship with neighboring and even farther districts should be considered in the planning.

[Continuation of JIANZHU XUEBAO No 2, 20 Feb 81 pp 1-7]

3. The Reconstruction of the Old City.
Efforts should be made to resolve the contradiction between the development in modernization and the preservation of the characteristics of the old city. The preservation of the old city should be included as an important element in city planning. The ancient architecture and its environment should be well taken care of, and the areas of gardens and greenery extended. Attention should be given to the traditional architectural style of the city in the reconstruction of the old dwellings and the modernization of public utilities.
4. The Path of Construction.
Unified planning and unified construction should be maintained instead of letting everyone go his own way. Policy should be formulated on problems like the control of population and the development of satellite towns. There should be a modern and scientific plan on the construction of the capital, a plan based on science and realized through policy.

AUTHOR: ZHENG Xiaoxie [6774 1321 3610]

ORG: None

TITLE: "Problems in City Planning in Socialist China"

SOURCE: Beijing JIANZHU XUEBAO [ARCHITECTURAL JOURNAL] in Chinese No 2, 20 Feb 81 pp 8-12

TEXT OF ENGLISH ABSTRACT: 1. The author disagrees with the statement that city planning is "the plan of city development within a certain period." He explains that city planning is manifested in the layout of land use in the city area, the important object of which is the good disposition of elements such as population, industry, communication, administrative and cultural organizations, dwellings, public services, green land, etc. City planning is the blueprint of construction and development within a certain period rather than the plan of city development in that period.

2. The author considers industry to be an important factor in the formation and development of a city, but not the only one. It depends on the local objective conditions, what kind of industry or whether industry at all should be developed. Cultural, scenic and other cities should not be considered as consuming ones. Not only natural, economic, cultural and historical conditions should be considered regarding the size of the city, but also the possibility and rationality of the extent of the environment to be developed.

[Continuation of JIANZHU XUEBAO No 2, 20 Feb 81 pp 8-12]

3. The general layout of a city should be started at a point (urban area) and extended to an area (district or suburb). This will aid in the rational disposition of city areas, in the control and reconstruction of old areas, in the control and distribution of population, in the disposition of agglomerations of different characteristics, and in the improvement of environment against pollution.

AUTHOR: WANG Shiren [3769 0013 0088]
JIANG Zhaocai [1203 0340 2088]
KONG Xianliang [1313 2009 5328]
YU Guoxiong [0151 0948 7160]

ORG: None

TITLE: "Proposals on City Planning of Chengde"

SOURCE: Beijing JIANZHU XUEBAO [ARCHITECTURAL JOURNAL] in Chinese No 2, 20 Feb 81 pp 21-28

TEXT OF ENGLISH ABSTRACT: The four proposals concerning the policy of constructing the capital forwarded by the Central Secretariat Office of the Chinese Communist Party, in the view of the authors, are of historical significance in the urban construction of Chinese socialist cities and far exceed the specific directive for the capital. The principles of proceeding from reality, of developing the strong points and avoiding the weaknesses, of judging the situation as a whole while emphasizing the individual, are applicable to all cities in the country.

Based on these principles, the authors propose the following points for the general layout of city planning of Chengde:
1. Recognition of the character of the city based on its individuality. Chengde should be planned as a socialistic city of national culture for summer resorts and tourism. Communication of the city with the capital should be strengthened.

[Continuation of JIANZHU XUEBAO No 2, 20 Feb 81 pp 21-28]

2. Effective protection of the tourist resources and strict control over items of construction.
3. Paying great attention to the general layout of planning and being resolute in moving out some of the industrial enterprises and administrative offices from the urban area.
4. Emphasizing the local architectural style and hastening the renovation of the historical buildings.

AUTHOR: XIE Ninggao [6200 0413 7559]

ORG: None

TITLE: "On the Beauty of Landscape"

SOURCE: Beijing JIANZHU XUEBAO [ARCHITECTURAL JOURNAL] in Chinese No 2, 20 Feb 81 pp 42-50

TEXT OF ENGLISH ABSTRACT: The author is of the opinion that only keen awareness of the characteristics of beauty of landscape will make the planning in conformity with objective reality, the architectural design with practical requirements, and the building in harmony with the environment. Two points are analyzed by the author: 1. The beauty of the natural landscape, including grandeur, queerness, steepness, elegance, serenity, openness, etc. The geological conditions forming these qualities, as well as the beauty of color, motion and sound, are also discussed. 2. The beauty of humanistic scenery, including cultural scenery, nationalistic, habitual and religious characteristics, as well as mythological and popular legends.

9717
CSO: 4009

AUTHOR: WANG Lianmin [3769 6647 2404]

ORG: None

TITLE: "A Solution of the Low-Velocity and Flat Trajectory"

SOURCE: Beijing BINGGONG XUEBAO [ACTA ARMAMENTARII] in Chinese No 1, Feb 81 pp 11-18

TEXT OF ENGLISH ABSTRACT: Starting from the characteristics of the air resistance coefficient of the low-velocity bullet, approximate to a constant, this paper simplifies the basic equations of the exterior ballistics, introduces a series of formulas for the characteristics of the low-velocity and flat trajectory at any point, and also finds the solutions for the data of the vertex, falling point, direct fire range and the exterior-ballistic design methods of the rifle grenades. It provides a simple method of the solution for the close-range anti-tank weapons widely used today. Calculation examples are given in the appendix.

AUTHOR: LIU Shuhua [0491 2885 5478]

ORG: None

TITLE: "Determination of the Reasonable Value of the Dispersion of Rocket Projectiles"

SOURCE: Beijing BINGGONG XUEBAO [ACTA ARMAMENTARII] in Chinese No 1, Feb 81 pp 19-28

TEXT OF ENGLISH ABSTRACT: The most important performance of the rocket projectile is its dispersion. During the launching of the rocket projectiles at area targets, the reasonable value of the dispersion must be required so as to improve the fire effectiveness. In this paper, the problem of the relationship between the mathematical expectation of the number of the target damaged M[w] and the dispersion of rocket projectiles is discussed. The expression for M[w] is presented on the assumption that each of the random variables is subordinate to the normal distribution and does not depend on the other, and the targets are under the typical conditions. This expression includes the accuracy and the dispersion of the rocket projectiles, consumption of the ammunition, the number of hits and the effective area of the target. With the values of other parameters fixed, a set of curves M[w] related to the ratio of the probable error of dispersion to the probable error of the center of bunching B_x/E_x or B_z/E_z can be made in accordance with the results of calculations. If the reasonable ratios of B_x/E_x or B_z/E_z and the

[Continuation of BINGGONG XUEBAO No 1, Feb 81 pp 19-28]

proper relative values of the probable error of the center of bunching $\bar{E}_x$ or $\bar{E}_z$ are selected and the ratio between the probable range error and the probable deviation in the lateral direction B_x/B_z is suitable to the ratio between the length and width of the rectangular target, the value M[w] will be obtained for optimization of design of the rocket projectiles.

AUTHOR: RUAN Huiqin [7086 1920 3830]
ZHANG Zhenjia [1728 2182 1367]

ORG: None

TITLE: "The Application of the Method of Statistical Testing to the Trajectory Design of Anti-tank Missiles"

SOURCE: Beijing BINGGONG XUEBAO [ACTA ARMAMENTARII] in Chinese No 1, Feb 81 pp 29-39

TEXT OF ENGLISH ABSTRACT: This paper discussed the whole process of solving the probability problem (the calculation of hit probability) and the non-probability problem (choosing system parameters of the missiles) by means of the method of statistical testing. A comparison between this method and the results of the linear analytic method is made.

AUTHOR: MA Yuyuan [7456 3768 1254]

ORG: None

TITLE: "A Study on the Velocity Dampings and Penetrating Depth of Small Preformed Fragments"

SOURCE: Beijing BINGGONG XUEBAO [ACTA ARMAMENTARII] in Chinese No 1, Feb 81 pp 52-58

TEXT OF ENGLISH ABSTRACT: Based on a series of experiments, formulas are established for calculating the drag coefficients, the velocity dampings and the penetrations into red pine of fragments of various shapes, including squares, triangles, cylinders and spheres. By applying these formulas and the accompanying diagrams and tables, the effective lethal radius for each kind of fragment can be predicted and calculated easily and effectively, thus providing a theoretical basis for the optimization of preformed fragment designs.

9717
CSO: 4009

AUTHOR: MAO Honglian [5374 3163 6647]
ZHANG Yangqin [1728 7402 0530]

ORG: None

TITLE: "JZ425 Loader"

SOURCE: Tianjin GONGCHENG JIXIE [CONSTRUCTION MACHINERY AND EQUIPMENT] in Chinese No 1, 20 Jan 81 pp 21-23, front cover

ABSTRACT: For the purpose of satisfying the needs of the harbors, the train stations, the warehouses, and the city's various departments of construction, the Yidy Engineering Machinery Plant of Shandong Province has succeeded in studying and making the JZ425 loader. It is a multi-purpose machine, suitable for loading ores, shoveling earth, loading and transporting lumber, loading and unloading loose materials, pushing dirt, loosening dirt, leveling land, tracting, lifting, etc. The essential technical parameters and the major structural characteristics of the loader are described. A photo of the loader, attached to a truck, appears on the front cover of this issue.

AUTHOR: HAN Lian [7281 1670]

ORG: Institute of Scientific Research, Daqing Construction Company

TITLE: "YZK-1 Hydraulic Borehole Expanding Machine"

SOURCE: Tianjin GONGCHENG JIXIE [CONSTRUCTION MACHINERY AND EQUIPMENT] in Chinese No 1, 20 Jan 81 pp 23-24

ABSTRACT: The YZK-1 hydraulic borehole expanding machine is a hole making machinery, operable in the winter or the summer, and capable of drilling through frozen earth. Its essential technical parameters, its work theory, and its major structure are described. There is a photo depicting the borehole machine at work.

AUTHOR: CHEN Lixiang [7115 2980 4382]

ORG: Hangzhou Municipal Automotive Transport Company, No 2

TITLE: "One Ton Hydraulic Dump Truck"

SOURCE: Tianjin GONGCHENG JIXIE [CONSTRUCTION MACHINERY AND EQUIPMENT] in Chinese No 1, 20 Jan 81 pp 25-26

ABSTRACT: On the basis of the Jianshe brand JS-1 one ton dump truck, the company experimented with designing the one ton hydraulic dump truck. The prototype has been tested and its properties have been rated to be satisfactory. Its major technical parameters and its structure are briefly introduced. There is a photo depicting its external appearance and a drawing depicting its transmission system.

AUTHOR: FU Qixin [0102 0366 0207]
TANG Zhengquan [0781 2398 5425]

ORG: Both of Yuejiashan Branch, Jinhe Phosphorite Mine, Sichuan Province

TITLE: "Improvements to the Exhaust of FJY25 Disk Type Quarrying Machine Frame"

SOURCE: Tianjin GONGCHENG JIXIE [CONSTRUCTION MACHINERY AND EQUIPMENT] in Chinese No 1, 20 Jan 81 pp 48-49

ABSTRACT: The FJY25 disk type quarrying machine frame is to be assembled with the YG80 guide rail type quarrying machine. The frame is small and light weight. It is easily moved and convenient to operate and repair. After it has been used for a prolonged period of time, due to the adverse work condition, a large quantity of mud and sand and fallen rocks constantly hit the frame while the frame vibrates violently during the operation to cause frequent malfunction of the exhaust cap. Analyses revealed that the screw joining the exhaust and the cylinder is often loosened by the vibration, the rubber dust-preventive gasket is often broken by the impact of fallen rocks, and the rubber seal of the cylinder is often damaged by friction. Corrective measures were adopted to overcome these shortcomings so that the period between repairs is greatly lengthened.

AUTHOR: None

ORG: Machine Repair and Manufacture Plant, Sicuan Provincial Bureau of Construction Engineering

TITLE: "Air-discharge Type Bulk Cement Truck"

SOURCE: Tianjin GONGCHENG JIXIE [CONSTRUCTION MACHINERY AND EQUIPMENT] in Chinese No 1, 20 Jan 81 p 55

ABSTRACT: The Machine Repair and Manufacture Plant remodeled Jiefang truck and Huanghe truck into 2 types of air-discharge type loose packed cement trucks, in capacities of 4 and 8 tons respectively. The horizontal cement tank, in both trucks, is lifted hydraulically into a 45°-48° position and air pressure is used to fluidize the loose packed cement so that it will discharge by itself. Photos are included to depict the cement trucks. With the cement tanks laying flat on the truck, the center of gravity is low and the truck moves stably. The cement may be discharged as fast as one ton per minute. There is no residue and no contamination. The air pressure machine and the hydraulic pump are both powered by the truck.

AUTHOR: CUI Aisheng [1508 1947 3821]
XIE Fuqiang [6200 1381 1730]

ORG: Both of Repair and Construction Brigade, Jinan Steel and Iron Mill

TITLE: "Hard Alloy Thin Wall Drill"

SOURCE: Tianjin GONGCHENG JIXIE [CONSTRUCTION MACHINERY AND EQUIPMENT] in Chinese No 1, 20 Jan 81 p 56

ABSTRACT: According to foreign data, the drill bit of thin-wall drills is usually made of artificial diamond. The cost for a drill bit of ϕ 80 holes is generally about 800 yuan. Furthermore, artificial diamond is not efficient for cutting the steel reinforcement in the concrete. The authors used YG8, YG15, C.311 type hard alloy instead. This type of hard alloy bit may even be sharpened after repeated use. The major technical parameters and the structural theory of the thin-wall drill machine are included.

6168
CSO: 4009

AUTHOR: ZHANG Rirong [4545 2480 2837]
LIU Shunxiang [0491 7311 4381]
ZHOU Kangjian [0719 1660 0256]

ORG: All of the Shijiazhuang Institute of Communication

TITLE: "Theoretical Analysis of the Dielectric Loaded Horn"

SOURCE: Beijing DIANZIXUE TONGXUN [JOURNAL OF ELECTRONICS] in Chinese No 1, 1981 pp 1-7

TEXT OF ENGLISH ABSTRACT: This paper gives a solution of the characteristic equations of the boundary conditions of the dielectric ring loaded horn. This leads to transformation formulas for the connecting boundary of the dielectric ring loaded waveguide and smooth walled waveguide. Using these formulas, the radiation characteristics of the dielectric ring loaded horn according to the design in the reference by Yang are found. The calculated values are very close to experimental results.

AUTHOR: ZHAO Liangui [6392 6647 6311]

ORG: None

TITLE: "Analysis and Improvement of the Five-Arm Ring and Design of a Five-Arm Ring Power Divider Having Three Different Power Ratios"

SOURCE: Beijing DIANZIXUE TONGXUN [JOURNAL OF ELECTRONICS] in Chinese No 1, 1981 pp 8-15

TEXT OF ENGLISH ABSTRACT: An analysis using the equivalent circuit method is made for the five-arm ring, and two ways to improve it are found. The improved method can make the center arm entirely match the ring, isolated ideally from the second pair of side arms, and can make the first pair of side arms perfectly match the ring, with both arms ideally isolated from each other. A method of design of a five-arm ring power divider having three different power ratios is proposed. Analysis and calculation formulas are given, and theoretical results and experimental findings agree quite closely.

AUTHOR: CHEN Jie [7115 2212]

ORG: Institute of Electronics, Chinese Academy of Sciences

TITLE: "The Error Probability of Detecting Phase-modulated Binary Codes on the Basis of the Threshold Decision Rule"

SOURCE: Beijing DIANZIXUE TONGXUN [JOURNAL OF ELECTRONICS] in Chinese No 1, 1981 pp 16-21

TEXT OF ENGLISH ABSTRACT: Based on the Threshold Decision rule, calculations are made of the error probability of detecting phase-modulated binary codes in the pseudo-random code system for the measuring of distance. The results are compared with results of measurements based on the maximum likehood decision rule. It is pointed out that under similar conditions, results obtained from measurements according to the two rules from the point of view of statistical average differ very little; results obtained from the former differ only by 3 dB from the latter, even when calculations are made according to the longest trapping time.

AUTHOR: PAN Huizhen [3140 1979 3791]
ZHANG Guicheng [1728 2710 2052]
XU Shaohua [1776 1421 5478]
et al.

ORG: All of Shanghai Institute of Metallurgy, Chinese Academy of Sciences

TITLE: "The Study of GaAs Double Heterojunction High-Radiance Light-Emitting Diodes"

SOURCE: Beijing DIANZIXUE TONGXUN [JOURNAL OF ELECTRONICS] in Chinese No 1, 1981 pp 22-28

TEXT OF ENGLISH ABSTRACT: GaAs-Ga_{1-x} Al_x As double heterojunction material was grown by the liquid phase epitaxial technique, and small-area high-radiance light-emitting diodes are made. The radiation power is above 100 W/sr. cm^2, output power of the tail fiber (inner diameter 60 μm, N.A. = 0.17) is 200 μW, and extrapolated life reaches 10^5 hours. It is already being used in the 1.8 km 8.448 Mb/s PCM-120 route optic fiber telephone communication system. Analysis is made on the operational characteristics of the diodes. Factors affecting its proper use and approaches for improvement are discussed.

AUTHOR: ZHANG Xiufen [1728 4423 5358]

ORG: Institute of Electronics, Chinese Academy of Sciences

TITLE: "A Microwave Method for Measuring the Matching Property of the Attenuators on the Supporting Rods in TWT"

SOURCE: Beijing DIANZIXUE TONGXUN [JOURNAL OF ELECTRONICS] in Chinese No 1, 1981 pp 29-34

TEXT OF ENGLISH ABSTRACT: A simple, rapid, directly observable method for examining the supporting rod type attenuator's matching property is discussed. The fundamental principle employed is to measure and work out the relative attenuation distribution curve of the attenuator at microwave frequencies, and then by phase shift method to measure the VSWR's value as an indication of matching quality of the attenuator in its region of slow variation in attenuation, and compare and analyze the obtained curve and S value in order to determine the required form of the curve and slope of the starting section. When these are established, in further examination work on attenuators all one needs to do is measure and work out an attenuator's microwave relative attenuation distribution curve to see if it meets the requirements established. By adopting this method, one increases greatly the rapidity of measurement. From experience we can say that this method is not only useful in the development research work on TWT, but is useful in the small-scale manufacturing of TWT's.

AUTHOR: PU Fen [5543 3083]

ORG: Institute of Electronics, Chinese Academy of Sciences

TITLE: "Experimental Studies of Continuous Tuning and Frequency Pulling Effect in Multiatmosphere CO_2 Laser"

SOURCE: Beijing DIANZIXUE TONGXUN [JOURNAL OF ELECTRONICS] in Chinese No 1, 1981 pp 35-38

TEXT OF ENGLISH ABSTRACT: Experimental studies on the continuous tuning and frequency pulling in a grating tuning multiatmosphere CO_2 laser are reported. A germanium prism beam expanding telescope or a spherical mirror beam expanding telescope is used in the cavity to improve the frequency selectivity of the dispersion cavity and enlarge the beam exposed area of the grating. In this way, we achieve continuous tuning with nearly no pulling effect in the continuous tuning and the grating is also effectively protected.

AUTHOR: GE Qi [5514 7221]
XU Shanshan [1776 3790 3790]
WANG Yuepo [3769 2588 0980]
WANG Peigang [3769 1014 0474]

ORG: All of the Institute of Electronics, Chinese Academy of Sciences

TITLE: "A Radial Electron Beam for Pumping Lasers"

SOURCE: Beijing DIANZIXUE TONGXUN [JOURNAL OF ELECTRONICS] in Chinese No 1, 1981 pp 39-44

TEXT OF ENGLISH ABSTRACT: An investigation into the radial relativistic electron beam for use as a gas laser pumping source is made. Design and experimental results of a coaxial electron gun for the production of a radial electron beam are given. Also a preliminary discussion of certain characteristics of this kind of beam is given. With this kind of electron beam, laser output in the ultraviolet region is obtained successfully.

AUTHOR: DAI Lisheng [2071 4539 4141]
YE Guimu [5509 2710 2606]

ORG: Both of the Institute of Electronics, Chinese Academy of Sciences

TITLE: "Resonator with Double-Curvature Mirror"

SOURCE: Beijing DIANZIXUE TONGXUN [JOURNAL OF ELECTRONICS] in Chinese No 1, 1981 pp 45-48

TEXT OF ENGLISH ABSTRACT: A resonator with a double-curvature mirror to be used as a resonator for optically-pumped lasers at very high efficiency is proposed. This resonator can be regarded as a combination of a stable-resonator and an unstable-resonator. It is a new type of resonator which is able to obtain a high quality laser beam.

AUTHOR: LU Yi [7120 5030]

ORG: Institute of Electronics, Chinese Academy of Sciences

TITLE: "An Investigation of the Ba Sr Tungstate Cathode Fabrication Methods"

SOURCE: Beijing DIANZIXUE TONGXUN [JOURNAL OF ELECTRONICS] in Chinese No 1, 1981 pp 49-51

TEXT OF ENGLISH ABSTRACT: An investigation of the Ba Sr Tungstate cathode was made. It was found that when the tungstate was prepared at 1050°C for 2 hours the product was stable in the atmosphere, and after storing in air with relative humidity of below 70 percent for 200 hours its increase in weight was only 0.2 percent. Cathodes made in this way have a reasonably long life.

AUTHOR: LI Yajun [2621 0068 0689]

ORG: Zhejiang University

TITLE: "Analysis of the Diode Peak-Value-Holding Circuit"

SOURCE: Beijing DIANZIXUE TONGXUN [JOURNAL OF ELECTRONICS] in Chinese No 1, 1981 pp 52-58

TEXT OF ENGLISH ABSTRACT: When an input signal is a non-periodic triangular pulse, an analysis is made of the relationship between the input and output signals. Based on the analysis, calculations are made of the trapping time, trapping error and attenuation of the output signal.

The non-linear characteristic of the diode is considered according to two different conditions in the case where the volt-ampere characteristic can be represented in exponential form. The author proposes an iteration form to solve the intermediate region of the two conditions.

AUTHOR: FANG Zhihao [2455 1807 6275]

ORG: Physics Department, Wuhan University

TITLE: "Analysis of Noise Characteristics of FET's"

SOURCE: Beijing DIANZIXUE TONGXUN [JOURNAL OF ELECTRONICS] in Chinese No 1, 1981 pp 59-61

TEXT OF ENGLISH ABSTRACT: Noise sources of the junction type FET and formulas for them are presented. These are practical formulas for common source, common grid and common drain for the FET in low, medium and high frequency regions, and are obtained by use of the Y admittance model. Also, a comparison is made of noise characteristics of the three configurations of the FET, from which certain principles in low noise design are suggested.

AUTHOR: PENG Hongxian [1756 3163 0341]
LIU Hanguo [0491 3352 0948]
ZHANG Jinyu [1728 6855 3768]

ORG: All of the Changchun Institute of Physics, Chinese Academy of Sciences

TITLE: "The Development of a Corrugated Horn Feed Cassegrainian Antenna"

SOURCE: Beijing DIANZIXUE TONGXUN [JOURNAL OF ELECTRONICS] in Chinese No 1, 1981 pp 62-64

TEXT OF ENGLISH ABSTRACT: After comparing many types of antennas, we decided on the corrugated horn feed cassegrainian antenna. After improvement in the input feeding method, the antenna becomes usable. After many flying tests it proves rugged enough. For X-band, the characteristics of the antenna are: diameter $D = 800$ mm, Gain $G = 34.7$ dB, Side lode $\angle 2$ percent, beam width $2\theta_{0.5} = 2^{\circ}47'$.

9717
CSO: 4009

AUTHOR: LU Dechun [7120 1795 4783]

ORG: Shanghai Radio Plant No 14

TITLE: "Large Scale Integrated Circuit Testing System Using Microcomputer Control"

SOURCE: Beijing DIANZI KEXUE JISHU [SCIENCE AND TECHNOLOGY OF ELECTRONICS] in Chinese No 3, 81 pp 14-16, 30

ABSTRACT: The problem of testing has become more and more complex and important following the rapid development of large scale integrated circuits, and the testing technique and system must also continue to develop. This paper describes the hardware and software considerations for the testing system using the China made DJS-051 microcomputer for control. The major aim of the design is to achieve low cost, fast result, and a capability of testing relatively complicated large scale integrated circuits. For the sake of simplification and cost reduction, the system design omits high speed dynamic parameters, but the use of microcomputer improves the reliability of the system. The hardware design and the software design of the test system are described in 2 separate parts of the paper, with flow diagrams to depict the test processes.

AUTHOR: None

ORG: None

TITLE: "Front Cover Explanation"

SOURCE: Beijing DIANZI KEXUE JISHU [SCIENCE AND TECHNOLOGY OF ELECTRONICS] in Chinese No 3, 81 front cover, p 20

ABSTRACT: The front cover of this issue of the journal is a photo depicting the WKX-80 microcomputer controlled line dicing machine tool, jointly designed and made by Hangzhou Radio Special Equipment Plant No 1, Jianchang Machine Plant, Jianzhong Machine Plant, and Guangzhou Radio Special Equipment Plant. It is suitable for processing various precision and complex metal and hard alloy punch molds, parts, or templets. It has the merits of strictly controlled function, high precision operation, high speed dicing, and convenient handling, etc.

AUTHOR: QIAN Juan [6929 3197]

ORG:

TITLE: "A Type of Infrared Remote Control Switch"

SOURCE: Beijing DIANZI KEXUE JISHU [SCIENCE AND TECHNOLOGY OF ELECTRONICS] in Chinese No 3, 81 p 37-

ABSTRACT: Infrared remote control has many merits. In foreign countries, integrated circuits and microprocessors suitable for use in infrared remote control devices are already available, and products of multi-channel infrared remote control devices composed of integrated circuits are being sold on the market, with a transmission distance of about 30 m. This paper explains the structure of the pocket-size 4 channel infrared remote control switch INFRAFERN [Japanese make ?], which is composed of a pocket transmitter and a receiver. Electrical theories of the transmitter, the pre-amplifier, and the receiver are illustrated with diagrams are briefly described.

AUTHOR: BAO Hanwei [7637 3352 1218]

ORG: Hong Kong Electronic Computer Engineering Company

TITLE: "My Views Concerning the Development of Electronic Computer Industry in China"

SOURCE: Beijing DIANZI KEXUE JISHU [SCIENCE AND TECHNOLOGY OF ELECTRONICS] in Chinese No 3, 81 pp 38, 36

ABSTRACT: The progress in China's electronic computer industry is definitely positive. Although there remains a certain distance from the advanced countries, a tremendous potential exists. With unified planning and leadership, the author is certain that it is possible for China to catch up within the coming decade. The author describes the current shortcomings in the computer industry to be (1) scientific research not coordinated with production; (2) research not coordinated with development; (3) production not coordinated with application; (4) producers not coordinated with users; (5) a deficiency of normal technical exchange channels. To overcome these shortcomings, the author suggests the extension of the single unit computers. For example, one unit produces microprocessors, such as the 8086; another produces memory units, such as the 2716 and 2732; another produces connecting and other accessories; and another produces magnetic bubble and its accessories. Mold templets should be used to divide the various functions of a computer. These unit molds may be assembled into special system of application as needed.

6168
CSO: 4009

AUTHOR: HU Shigeng [5170 6684 5087]

ORG: None

TITLE: "The General Form of Separation Axiom"

SOURCE: Wuhan HUAZHONG GONGXUEYUAN XUEBAO [JOURNAL OF HUAZHONG INSTITUTE OF TECHNOLOGY] in Chinese Vol 8 No 4, 1980 pp 1-6

TEXT OF ENGLISH ABSTRACT: Many unequally strong-weak conditions of separation are used in general topology. We advance in this paper a general separation condition and set up corresponding theorems to integrate with the concepts and theorems about the related separateness of neighborhood. At the same time, we have tried our best to give nonstandard expressions under different conditions.

AUTHOR: WANG Bingnan [3769 3521 0589]

ORG: Electrical Engineering Institute, Chinese Academy of Sciences

TITLE: "Mathematical Models of Two-Dimensional MHD Channel Flow in Diagonal Type MHD Generator and Its Numerical Solution"

SOURCE: Wuhan HUAZHONG GONGXUEYUAN XUEBAO [JOURNAL OF HUAZHONG INSTITUTE OF TECHNOLOGY] in Chinese Vol 8 No 4, 1980 pp 7-22

TEXT OF ENGLISH ABSTRACT: Mathematical models of two-dimensional, compressible turbulent flow of seeded plasm in the diagonal type MHD channel are proposed. Emphasis is placed on the setting up of the implicit finite-difference equations for the gasdynamic part and the equations of the generator equivalent circuits for the electrodynamic part as well as the iteration method for solving them. The implicit finite-difference scheme possesses in numerical calculation the advantage of higher stability to any marching steps along the channel. As Maxwell partial differential equations are replaced by equivalent circuit equations, the solution process is greatly simplified.

AUTHOR: ZHOU Guanxiong [0719 0385 7160]
HU Bijin [5170 1801 6930]

ORG: None

TITLE: "Mathematical Model for the Net-Tree Pattern Recognition"

SOURCE: Wuhan HUAZHONG GONGXUEYUAN XUEBAO [JOURNAL OF HUAZHONG INSTITUTE OF TECHNOLOGY] in Chinese Vol 8 No 4, 1980 pp 23-28

TEXT OF ENGLISH ABSTRACT: The idea of graph theory is introduced into pattern recognition to solve a type of recognition problem. The concept of characteristic matrix and characteristic vector on the net-tree graph is proposed by satisfying the conditions usually required by preprocessing. A mathematical model and its algorithm are given for the recognition of the net-tree graph, and the relation between the model and the graph in question is proved.

AUTHOR: REN Shiyan [0117 1102 8746]

ORG: None

TITLE: "Mathematical Model for Transfer Function"

SOURCE: Wuhan HUAZHONG GONGXUEYUAN XUEBAO [JOURNAL OF HUAZHONG INSTITUTE OF TECHNOLOGY] in Chinese Vol 8 No 4, 1980 pp 29-36

TEXT OF ENGLISH ABSTRACT: A mathematical model of transfer function is proposed for any linear R, L, C circuit and steady linear system. Based on this model and the experimental real frequency characteristics, a method for solving the transfer function with a computer is given. The experimental verification of the mathematical model is described.

AUTHOR: CHEN Yaokui [7115 5069 7145]
ZHENG Youming [6774 0645 2499]

ORG: None

TITLE: "New Tabulating Method for Switch Function Minimization"

SOURCE: Wuhan HUAZHONG GONGXUEYUAN XUEBAO [JOURNAL OF HUAZHONG INSTITUTE OF TECHNOLOGY] in Chinese Vol 8 No 4, 1980 pp 37-44

TEXT OF ENGLISH ABSTRACT: In this paper, another tabulating technique, called the adjacent number tabulation method, for the minimization of switch functions is proposed. The method has two advantages: it is intuitive and regular in producing a minimal function and applicable to multivariable cases.

AUTHOR: ZHANG Duanming [1728 4551 2494]
LEI Shizu [7191 1709 4371]
ZHANG Jinru [1728 6855 1172]

ORG: None

TITLE: "Spin and Relativistic Covariance--An Investigation of the Essence of the Spin"

SOURCE: Wuhan HUAZHONG GONGXUEYUAN XUEBAO [JOURNAL OF HUAZHONG INSTITUTE OF TECHNOLOGY] in Chinese Vol 8 No 4, 1980 pp 45-54

TEXT OF ENGLISH ABSTRACT: This paper proves that the origin of the spin is essentially a relativistic effect of the field, and the spin is with space-time geometric properties both in the classical and quantum field theories. The magnitude of the spin can be determined entirely by the space-time transformation characteristics of the field. However, the spin commutates with all other space-time quantities, and thus it appears to have some intrinsic properties and is a mechanical quantity of a unique feature. It should be pointed out that the structure and extension of the particles must be taken into account in further investigations.

AUTHOR: XUE Zhongchuan [5641 0022 1557]
WANG Zhifa [3769 2535 4099]
LI Ruzhen [2621 1172 3791]
TAO Meifang [7118 5019 5364]
CHENG Zhenzhong [4453 2182 0022]

ORG: None

TITLE: "A New Shipform of Flat Bow and Cochlea-channeled Stern"

SOURCE: Wuhan HUAZHONG GONGXUEYUAN XUEBAO [JOURNAL OF HUAZHONG INSTITUTE OF TECHNOLOGY] in Chinese Vol 8 No 4, 1980 pp 55-68

TEXT OF ENGLISH ABSTRACT: A new shipform of flat bow and cochlea-channeled stern is described, which is a development and crafty combination of the "flat bow shipform" of ancient China and the "cochlea-channeled stern shipform" developed by Giovanni B. Tommasi in the '70's.

Comparative tests on the ship models show that when Ⓚ = 2.8∼3.4, the resistance to the new ship is decreased by 25∼40 percent, the wave height from the bow is decreased by more than 60 percent, propulsive efficiency is increased by 35∼45 percent and the engine power can be saved by the amount of 35∼45 percent. Judging by the excellent performance the new shipform possesses, it can well be said that it is a promising inland river shipform.

[Continuation of HUAZHONG GONGXUEYUAN XUEBAO Vol 8 No 4, 1980 pp 55-68]

The influence of the bow and stern on ship performance is discussed, the abnormal phenomena observed during investigations are analyzed and theoretical inferences are made. The first full-scale ship's trial trip is also treated.

AUTHOR: WANG Shiliang [3769 1102 5328]

ORG: None

TITLE: "On the Unifying Admittance Calculation--Comments on H. Schering's Conception $\delta = 90 - |\varphi|$"

SOURCE: Wuhan HUAZHONG GONGXUEYUAN XUEBAO [JOURNAL OF HUAZHONG INSTITUTE OF TECHNOLOGY] in Chinese Vol 8 No 4, 1980 pp 69-77

TEXT OF ENGLISH ABSTRACT: There exist two relative theories of the alternating current circuit, the theory of constant current source and that of constant voltage source. Therefore, there are also two relative methods, the method of unifying admittance calculation and that of unifying impedance calculation. In the alternating current bridge methods, generally speaking, both of these calculations are randomly used and may sometimes cause trouble during bridge circuit analysis. From the history of the development of the bridge, it can be seen that the unifying impedance calculation is well defined. According to this kind of calculation, the dissipation factor of the capacitor and insulating material must be a negative value, which was proved by H. Schering in the 20's. As for the unifying admittance calculation, we can only see its elementary forms, and the author thinks it necessary to improve this situation and give it a complete form. According to the unifying admittance calculation, the Q-value of the inductance component must be negative and the time constant (= CR - L/R) differs from the conventional expression

[Continuation of HUAZHONG GONGXUEYUAN XUEBAO Vol 8 No 4, 1980 pp 69-77]

(= L/R - CR). While criticizing H. Schering's conception ($\delta = 90 - |\varphi|$), it is pointed out that the study of the unifying admittance calculation will help analyze the capacitance dielectric loss bridge and, in particular, analyze the method of calculating the separate equilibrium of the value-phase angle of the precision dielectric loss capacitance bridge ($y_1y_4 = y_2y_3, \varphi_1' + \varphi_4' = \varphi_2' + \varphi_3'$).

AUTHOR: XU Shizhang [6079 1395 4545]
MA Zhiyun [7456 1807 0061]

ORG: None

TITLE: "Stator Pole-Changing in Large Pole-Changing Synchronous Generator-Motor"

SOURCE: Wuhan HUAZHONG GONGXUEYUAN XUEBAO [JOURNAL OF HUAZHONG INSTITUTE OF TECHNOLOGY] in Chinese Vol 8 No 4, 1980 pp 79-88

TEXT OF ENGLISH ABSTRACT: Various ways of stator pole-changing in a large synchronous generator-motor are described, and methods of connection and harmonic content with either double winding or single winding are briefly discussed. A satisfactory method is chosen after elaborate comparison between different pole-changing schemes with regard to electromagnetic vibration, temperature rise, manufacturability and economy.

AUTHOR: LI Langru [2621 2597 1172]
TANG Xiaogao [0781 1321 6964]

ORG: None

TITLE: "Rotor-Pole Changing of Salient-Pole Synchronous Machines"

SOURCE: Wuhan HUAZHONG GONGXUEYUAN XUEBAO [JOURNAL OF HUAZHONG INSTITUTE OF TECHNOLOGY] in Chinese Vol 8 No 4, 1980 pp 89-98

TEXT OF ENGLISH ABSTRACT: The use of the principle of pole-amplitude modulation in designing pole-changing salient-pole synchronous machines is discussed and the advantages and disadvantages of various pole-changing schemes are compared by calculation of the magnetic field in the air-gap. A common principle of the pole-changing rotor design is suggested for improving the frequency spectrum of the magnetic field in the air-gap, and a method of determining the layout for "pole shoes of different sizes and unequal pole pitches" is also given. The pole-changing rotor to be used in a 100 MW machine of a pumped storage power plant in China is therefore proposed. Requirements for matching of the pole-changing scheme of stator and rotor are also made.

AUTHOR: ZHAN Qionghua [6124 8825 5478]
TANG Xiaogao [0781 1821 6964]

ORG: None

TITLE: "The Finite Element Method for the Field Calculation of Pole-Changing Salient-Pole Synchronous Machines"

SOURCE: Wuhan HUAZHONG GONGXUEYUAN XUEBAO [JOURNAL OF HUAZHONG INSTITUTE OF TECHNOLOGY] in Chinese Vol 8 No 4, 1980 pp 99-108

TEXT OF ENGLISH ABSTRACT: Mathematical models for calculating the no-load air-gap field and the on-load armature field as well as the air-gap coefficient with the slot opening taken into account are developed by using the finite element method for a 100 MW pole-changing synchronous machine. Solutions are obtained by computer and formulas for calculating the leakage permeance and the air-gap permeance are derived by Fourier series and magnetic energy method. All the mathematical models and formulas derived are of universal significance and can be used for studying and designing specific machines and other electrical devices.

AUTHOR: XU Shizhang [6079 1395 4545]

ORG: None

TITLE: "Vibrations of Stator-Core of Large Pole-Changing Generator-Motor for Pumped-Storage Power Station"

SOURCE: Wuhan HUAZHONG GONGXUEYUAN XUEBAO [JOURNAL OF HUAZHONG INSTITUTE OF TECHNOLOGY] in Chinese Vol 8 No 4, 1980 pp 109-118

TEXT OF ENGLISH ABSTRACT: By taking a specific machine as an example, the vibrations of the stator-core of a large pole-changing generator-motor in a power station are analyzed in detail, and by comparison of the vibrations between pole-changing machines with single-winding and double winding, it is concluded that from the point of view of magnetic vibration priority should be given to machines with single-winding.

AUTHOR: TANG Xiaogao [0781 1321 6964]
ZHAN Qionghua [6124 8825 5478]

ORG: None

TITLE: "The Calculation of Parameters of Pole-Changing Salient-Pole Synchronous Machines"

SOURCE: Wuhan HUAZHONG GONGXUEYUAN XUEBAO [JOURNAL OF HUAZHONG INSTITUTE OF TECHNOLOGY] in Chinese Vol 8 No 4, 1980 pp 119-128

TEXT OF ENGLISH ABSTRACT: According to the features of the magnetic field of the pole-changing salient-pole synchronous machines, the methods of reactance calculation are proposed. For different pole-changing rotor designs used in a 100 MW generator-motor for a power station, the salient-pole is either eliminated (that is, $x_{ad} = x_{aq}$) or weakened.

AUTHOR: CHEN Benxiao [7115 2609 1321]

ORG: None

TITLE: "Alternating Large Current Measurement Apparatus for Error Analysis of Inertia Component"

SOURCE: Wuhan HUAZHONG GONGXUEYUAN XUEBAO [JOURNAL OF HUAZHONG INSTITUTE OF TECHNOLOGY] in Chinese Vol 8 No 4, 1980 pp 129-136

TEXT OF ENGLISH ABSTRACT: In order to eliminate integration drift in three-phase alternating large current measurement apparatus, the substitution of inertia link (approximate integration circuit) for the integration circuit is proposed by our Research Group. The errors of inertia link have been analyzed theoretically by referring to quantities to be measured--the steady alternating current and transient peak current, as well as their mathematical expressions, proving the rationality of the proposition and obtaining the relative parameters required for rational design so that errors can be kept within the permissible range.

AUTHOR: LU Yanshou [4151 1693 1108]

ORG: None

TITLE: "Methods of Mode Changing by Using the Cycle Counterdown"

SOURCE: Wuhan HUAZHONG GONGXUEYUAN XUEBAO [JOURNAL OF HUAZHONG INSTITUTE OF TECHNOLOGY] in Chinese Vol 8 No 4, 1980 pp 137-144

TEXT OF ENGLISH ABSTRACT: By an analysis of the relationship between the waveforms of the cycle five-counterdown in the current switch, several methods for mode changing by using this circuit are given. Logical combinations are studied, the resolution for the present counterdown is discussed and the test circuit is presented.

AUTHOR: YANG Shuzi [2799 0647 1311]
SHI Hanmin [1597 3352 3046]

ORG: None

TITLE: "The Application of δ-Function in Machine Building"

SOURCE: Wuhan HUAZHONG GONGXUEYUAN XUEBAO [JOURNAL OF HUAZHONG INSTITUTE OF TECHNOLOGY] in Chinese Vol 8 No 4, 1980 pp 145-154

TEXT OF ENGLISH ABSTRACT: Some typical applications of the δ-function in machine building are given with explanations. The significance of the δ-function for the analysis of mechanical systems, the application of the δ-function to establish the relations between periodic function spectrum analysis and non-periodic function spectrum analysis, distributed and concentrated quantities, continuous and discontinuous quantities as well as process excitement and initial excitement are discussed.

AUTHOR: SHI Hanmin [1597 3352 3046]

ORG: None

TITLE: "Graphic Determination of Geometric Angles on Metal-Cutting Tools"

SOURCE: Wuhan HUAZHONG GONGXUEYUAN XUEBAO [JOURNAL OF HUAZHONG INSTITUTE OF TECHNOLOGY] in Chinese Vol 8 No 4, 1980 pp 155-164

TEXT OF ENGLISH ABSTRACT: By the mapping method the relevant planes and straight lines of a cutting tool can be mapped on a projection plane, and then all the angles of the cutting tool in both tool-in-hand and tool-in-use systems can be determined by a simple plane geometric procedure. The advantage of this method is that the effects of various parameters concerning the structure, mounting and motion of a cutting tool on its geometric angles can be intuitively shown. This will make it easier to synthesize and optimize these parameters from the point of view of cutting performance. Furthermore, it is possible to use this method for man-machine interaction in CAD and CAM of complicated cutting tools.

AUTHOR: YANG Xuguang [2799 4872 0342]
LI Shuzhen [2621 3219 3791]
YU Xingzhuo [0151 5281 0213]

ORG: None

TITLE: "Self-excited Vibration during Traverse Cylindrical Grinding"

SOURCE: Wuhan HUAZHONG GONGXUEYUAN XUEBAO [JOURNAL OF HUAZHONG INSTITUTE OF TECHNOLOGY] in Chinese Vol 8 No 4, 1980 pp 165-174

TEXT OF ENGLISH ABSTRACT: This paper analyzes the self-excited vibration during grinding, its features and conditions of occurrence, and discusses the assessment of machine tool antivibration behavior by grinding. The random vibration concept of treating grinding vibration is applied and a method for measuring the grinding vibration is developed. The influences of the grinding parameters on the occurrence of vibration are studied theoretically and experimentally. A new approach to the calculation of the overlap factor is proposed.

AUTHOR: HE Yongbiao [0149 3057 2871]
LU Huailiang [5684 3037 0081]
JIA Qingxiong [6328 1987 4382]
ZHOU Yunan [0719 0067 1344]

ORG: JIA of the Wuhan Steam Turbine Generator Works; ZHOU of Echeng Forging Press Plant

TITLE: "On the Design of the Hydraulic System of a Hydraulic Drive Screw Press"

SOURCE: Wuhan HUAZHONG GONGXUEYUAN XUEBAO [JOURNAL OF HUAZHONG INSTITUTE OF TECHNOLOGY] in Chinese Vol 8 No 4, 1980 pp 175-184

TEXT OF ENGLISH ABSTRACT: Through the experiment and study of the 630 T Hydraulic Drive Screw Press, the functions and basic circuits that these types of presses have to possess are discussed. The principle that the terminal pressure difference can be decreased to pre-pressurizing and pre-relieving is used to reduce the hydraulic shock. The formulas for calculating the related parameters and relevant technical data are also given.

AUTHOR: DUAN Yuancai [3008 6678 2088]

ORG: None

TITLE: "The Stiffness of Highly Flexible Coupling with Rubber Plugs"

SOURCE: Wuhan HUAZHONG GONGXUEYUAN XUEBAO [JOURNAL OF HUAZHONG INSTITUTE OF TECHNOLOGY] in Chinese Vol 8 No 4, 1980 pp 185-190

TEXT OF ENGLISH ABSTRACT: This paper presents a calculating method for static stiffness and a new measuring method of dynamic stiffness of the rubber coupling. Taking the marine diesel-generator set of type 6300Z-TFH630/10 as an example, the author analyzes the influence of variation of dynamic stiffness on torsional vibration of the unit. The influence on the torsional vibration characteristics of the unit when one or two rubber plugs of the coupling are damaged is also evaluated.

AUTHOR: LIU Liequan [0491 3525 0356]

ORG: None

TITLE: "Stability of Ring-Stiffened Cylindrical Shells of Oval Cross Sections"

SOURCE: Wuhan HUAZHONG GONGXUEYUAN XUEBAO [JOURNAL OF HUAZHONG INSTITUTE OF TECHNOLOGY] in Chinese Vol 8 No 4, 1980 pp 191-196

TEXT OF ENGLISH ABSTRACT: Three types of instability of ring-stiffened cylindrical shells of oval cross sections under external pressure are discussed. The expression for critical pressure of oval rings under normal pressure is proposed.

AUTHOR: ZHANG Peirong [1728 1014 2827]

ORG: None

TITLE: "Transforming of Bearing Load into Force of Nodals in Plane Finite Element Calculation"

SOURCE: Wuhan HUAZHONG GONGXUEYUAN XUEBAO [JOURNAL OF HUAZHONG INSTITUTE OF TECHNOLOGY] in Chinese Vol 8 No 4, 1980 pp 197-208

TEXT OF ENGLISH ABSTRACT: It is known that in plane finite element calculation the bearing load must be transformed into force of nodal. Currently used methods of transformation are: 1) integral average method, 2) average integral method, and 3) trapezoid method. Since some approximation is made in these methods, the calculation results are approximately nonnumerical.

Based on the equivalent theory of statics, this paper presents an accurate numerical method and accurate numerical formulas for calculating the bearing load distributed by cosine curve law are derived.

The method developed in this paper can increase the accuracy of calculated results and be used to draw up a universal computer program for the finite element method.

AUTHOR: YANG Zhenpeng [2799 2182 7720]

ORG: None

TITLE: "The Bubble Motion in the Boundary Layer of the Pipe Flow"

SOURCE: Wuhan HUAZHONG GONGXUEYUAN XUEBAO [JOURNAL OF HUAZHONG INSTITUTE OF TECHNOLOGY] in Chinese Vol 8 No 4, 1980 pp 209-214

TEXT OF ENGLISH ABSTRACT: The forces acting on the bubble remaining on the heating surface of the pipe are described and the formula for calculating the critical diameter above which the bubble departs from the surface is derived. The relations between the bubble detachment, the velocity of the fluid and the density difference are explained. The forces acting on the departing bubble are also analyzed and the formulas for calculating the relative velocity and the velocity with which the bubble moves to the tube axis are obtained.

AUTHOR: CAO Zeyi [2580 0263 4135]

ORG: None

TITLE: "More on the Optimum Velocity Ratio of the Intermediate Stages and the Application of the Small Velocity Ratio in the Design of Multistage Turbines"

SOURCE: Wuhan HUAZHONG GONGXUEYUAN XUEBAO [JOURNAL OF HUAZHONG INSTITUTE OF TECHNOLOGY] in Chinese Vol 8 No 4, 1980 pp 215-226

TEXT OF ENGLISH ABSTRACT: It is demonstrated by theoretical analysis and practical calculation that the optimum velocity ratio of the intermediate stages is not in proportion to, but is smaller than the velocity ratio at the axial exhaust (minimum leaving velocity loss). The shorter the blades, the more the velocity ratio will decrease. The article also discusses the technical and economic advantages of adopting the small velocity ratio for the intermediate stages based on the fact that the top of the efficiency curve of the intermediate stages is comparatively flat.

AUTHOR: YI Xinjian [2496 2460 1696]
XU Ribing [1776 2480 3521]

ORG: XU of Research Institute No 1444

TITLE: "Ion Sputtering of Titanium, Platinum and Gold"

SOURCE: Wuhan HUAZHONG GONGXUEYUAN XUEBAO [JOURNAL OF HUAZHONG INSTITUTE OF TECHNOLOGY] in Chinese Vol 8 No 4, 1980 pp 227-232

TEXT OF ENGLISH ABSTRACT: The sputtering conditions of the metallization systems of Pt_5Si_2-Ti-Pt-Au layers by D.C. multitarget sputtering are described and the forming mechanism of the beam lead and Schottky barrier diode is discussed.

AUTHOR: QI Yuansui [2058 0337 3606]

ORG: None

TITLE: "The Design of Fresnel Lens and Its Application in the Enlargement-Duplicator"

SOURCE: Wuhan HUAZHONG GONGXUEYUAN XUEBAO [JOURNAL OF HUAZHONG INSTITUTE OF TECHNOLOGY] in Chinese Vol 8 No 4, 1980 pp 233-244

TEXT OF ENGLISH ABSTRACT: The calculating formulas of groove shape, groove depth, groove pitch, dim-ring width, spherical aberration and mold errors of plastic thin-fringe Fresnel lens when the object and image distance are both limited distances are derived. Various factors affecting the dim-ring of the Fresnel lens are analyzed in detail, and the designs of Fresnel condensing lenses and large-scale Fresnel image-field lenses are illustrated with examples.

9717
CSO: 4009

AUTHOR: ZHAO Jingwen [6392 4842 2429]
WANG Hongyu [3769 1347 6877]

ORG: Both of the Department of Mechanics

TITLE: "A Hybrid Stress Element of Cylindrical Shells"

SOURCE: Harbin HARBIN GONGYE DAXUE XUEBAO [JOURNAL OF HARBIN INSTITUTE OF TECHNOLOGY] in Chinese No 4, Dec 80 pp 1-11

TEXT OF ENGLISH ABSTRACT: Based on the modified principle of complementary energy, a hybrid stress shell element is formulated in the cylindrical coordinate system. The complete linear membrane stresses and bending moments are included in the expressions in this element and the transverse shears are assumed to be constant. It has four nodes and 20 d.o.f. in displacement. The transverse shear effects can be taken into account in the complementary energy and then this element can be used to analyze either thin shells or moderate thick shells. Combined with the compatible element of a curved beam, this hybrid element can be used to analyze the stiffened shells.

Some minor problems with selecting the stress parameters in the element and the boundary displacements of the element are discussed in this paper. In order to avoid the singularity, the rank of the transformation matrix [G] must not be less than n-1 (n is the d.o.f. of the boundary displacements and 1 is the number of the rigid body motion).

AUTHOR: WANG Dianfu [3769 3013 1381]

ORG: Department of Mechanics

TITLE: "The Application of Reliability Design to the K-Criterion in Fracture Mechanics"

SOURCE: Harbin HARBIN GONGYE DAXUE XUEBAO [JOURNAL OF HARBIN INSTITUTE OF TECHNOLOGY] in Chinese No 4, Dec 80 pp 12-18

TEXT OF ENGLISH ABSTRACT: The tentative idea in this paper is to explore the applicability of the concept "probability fracture" in design. In a strict sense, the safety factor used in conventional design has become confused. In fact, the fracture toughness K_c of a material and the stress intensity factor are both the functions of random variables, so it would be appropriate to consider the fracture criterion and fatigue crack growth path as random variables and stochastic processes. The reliability is accordingly considered as the probability of crack growth resistance K_c exceeding crack growth drive K, i.e.

$$R = P(\zeta > 0) = \int_0^\infty \overline{f(\zeta)}\, d\zeta$$

where

$$\zeta = K_c - K.$$

When the functions K_c and K conform to the normal distribution

$$R = \frac{1}{\sqrt{2\pi}} \int_{-\mu\zeta/\sigma\zeta}^{\infty} exP[-Z^{2}/_{2}]dZ$$

[Continuation of HARBIN GONGYE DAXUE XUEBAO No 4, Dec 80 pp 12-18]

the fundamental equation for reliability design is

$$Z = -\mu_\zeta/\sigma_\zeta = -(\mu_{K_c} - \mu_K)/\sqrt{\sigma_{K_c}^2 + \sigma_K^2}\ .$$

In such a way the accurate expressions for the mean and the standard deviation of function of random variable K are obtained. In this paper, such a kind of reliability analysis is used for the leak-versure-rupture phenomenon of thin-walled pressure vessel of high strength steel with a surface flaw on it. The predicted rupture pressure is compared with the results of prototype rupture tests.

The results show that the reliability design is better than the conventional method.

AUTHOR: GAI Bingzheng [5556 4426 2398]

ORG: Department of Materials Mechanics

TITLE: "The Revision of Indented Hardness Value on a Curve-Surface Specimen"

SOURCE: Harbin HARBIN GONGYE DAXUE XUEBAO [JOURNAL OF HARBIN INSTITUTE OF TECHNOLOGY] in Chinese No 4, Dec 80 pp 19-37

TEXT OF ENGLISH ABSTRACT: The so-called revision of indented hardness value on a curved surface specimen is a problem in how to determine the relation between the indented hardness value on a plane specimen and that on a curved surface specimen. It is a comparatively complex space elastic-plastic contact problem, and it is very difficult to find the exact solution theoretically. This topic has hitherto been studied by many investigators because it is significant in practice. However, the results, more complete and suitable for practical use, have not been obtained so far. This paper aims to make a thorough discussion of the problems involved in this topic by an analogy between elastic and elastic-plastic solutions on semispace. All calculating formulas of the modified value or modified coefficient are given. Their features are: (1) The type of formula is universal. It is suitable for use for any curved surface specimen, any range of hardness value and any scale of hardness test. (2) By using these formulas, the accuracy is quite satisfactory and the results seem to all agree with experimental data. (3) The simplicity of the formulas and the convenience for calculation make them suitable for practical use.

AUTHOR: LIU Huaming [0491 5478 2494]

ORG: Department of Cutting Tools

TITLE: "The Error of Rectangular Spline Hob Profile Designed on the Theory of Plane Engagement"

SOURCE: Harbin HARBIN GONGYE DAXUE XUEBAO [JOURNAL OF HARBIN INSTITUTE OF TECHNOLOGY] in Chinese No 4, Dec 80 pp 38-47

TEXT OF ENGLISH ABSTRACT: This paper gives a calculating method of the error of rectangular spline hob profile designed on the theory of plane engagement, with the errors of some hobs calculated. Consequently, a fundamental conception of the precision of designing on this theory has been established. It is a critical problem for affirming the value of designing method on the theory of plane engagement.

In order to calculate the error of the hob profile, we must first set up the equation for the hob spiral surface. For the solution of this problem, this paper also gives an analytic method using an imaginary rack as the medium. It is a much simpler method than those commonly used.

AUTHOR: LIU Run [0491 3387]

ORG: Department of Electrical Engineering Fundamentals

TITLE: "Network Function Matrix Method--A Kind of Method of Formulating State Equation"

SOURCE: Harbin HARBIN GONGYE DAXUE XUEBAO [JOURNAL OF HARBIN INSTITUTE OF TECHNOLOGY] in Chinese No 4, Dec 80 pp 48-62

TEXT OF ENGLISH ABSTRACT: This paper introduces a kind of method for formulating the state equation to apply to the concept of network function. In order to state it conveniently, we study the formal network first, then the informal network.

AUTHOR: YAN Jialu [0917 1367 7498]

ORG: Department of Engineering Thermophysics

TITLE: "A New Generalized Equation of State for Real Gases"*

SOURCE: Harbin HARBIN GONGYE DAXUE XUEBAO [JOURNAL OF HARBIN INSTITUTE OF TECHNOLOGY] in Chinese No 4, Dec 80 pp 63-80

TEXT OF ENGLISH ABSTRACT: A new generalized equation of state for real gases is given in a reduced form. It is based on van der Waal's equation and takes into account the association of molecules as well as the influence of temperature on the force between molecules and on the molecular volume.

A large number of calculations made with the new equation for various gases are in substantial agreement with experimental data. Thus, the generality of the new equation is proved.

When the new equation is used to calculate the relations between temperature, pressure and specific volume for a given gas, only the critical parameters of the gas are needed. Furthermore, the new equation is universal, simple and accurate. It is applicable to a broad range of parameters and is clear in physical concepts.

The new equation serves as a powerful tool for studying the properties of working media in power engineering, chemical engineering, refrigerating engineering,

[Continuation of HARBIN GONGYE DAXUE XUEBAO No 4, Dec 80 pp 63-80]

research work on new energy sources and other related areas. It may be used for the interpolation and extrapolation of experimental data. It also provides a good formula for computer use.

The new equation is especially helpful in the study of the properties of gases for which sufficient experimental data are not available. In these cases much time and money for the experiments may be saved.

* This paper was presented at the National Symposium of Engineering Thermophysics held in November 1978 in Hangzhou.

AUTHOR: DAI Zongshu [0108 1350 1859]

ORG: Department of Electronic Computers

TITLE: "Study of Digital Computer Arithmetic. Part II. Three Number Systems Without Carrying--R-System, IR-System and RIR-System"

SOURCE: Harbin HARBIN GONGYE DAXUE XUEBAO [JOURNAL OF HARBIN INSTITUTE OF TECHNOLOGY] in Chinese No 4, Dec 80 pp 81-94

TEXT OF ENGLISH ABSTRACT: Following Part I, the author in Part II further presents two other number systems without carrying. For brevity, these three systems are called the R-system, IR-system and RIR-system respectively.

The R-system is the number system with setting residues that is introduced in Part I. The IR-system has a logarithmic character, but is far superior to general logarithms. The RIR-system is obtained by applying the R-system theory again to the IR-system, improving the quality of the number system a step further.

This paper defines respectively the above-mentioned three number systems without carrying, describing and demonstrating their arithmetic operations.

In Part III, the author will deduce from the RIR-system the concept of the so-called RIR-number field, proving that this RIR number field is a unifield of a

[Continuation of HARBIN GONGYE DAXUE XUEBAO No 4, Dec 80 pp 81-94]

vector field representing the multiplication-division relation and a construction field representing the addition-subtraction relation. The author wants to deduce from it a new calculator principle.

AUTHOR: WANG Zhongren [3769 0112 0088]
LI Shoudong [2621 1343 2767]
LIU Lijun [0491 4539 0689]

ORG: All of the Forging Department

TITLE: "Division of the State of Stresses on the Mises Circular Cylinder and Discussions on the Location of Typical Metal Forming Processes in Stress Space"

SOURCE: Harbin HARBIN GONGYE DAXUE XUEBAO [JOURNAL OF HARBIN INSTITUTE OF TECHNOLOGY] in Chinese No 4, Dec 80 pp 95-102

TEXT OF ENGLISH ABSTRACT: The yield criteria in the principal stress space is represented by a Mises circular cylinder or by a regular hexagonal cylinder which is conventionally inscribed within the Mises cylinder. The division of the state of plane plastic stress and the location on the Mises ellipse and Tresca hexagon and loading path are given in Wang's previous article.

In this paper the division of the state stress on the Mises circular cylinder, the locus of hydrostic (or mean) stress on the interlines, the location of the state of stress in some metal forming processes in principal stress space are presented in three-dimensional systems under the condition $\sigma_1 \geqslant \sigma_2 \geqslant \sigma_3$.

It is assumed that spreading the Mises circular cylinder to a plane is a convenient method, and the $\sigma_m - \theta$ stress plane is given first (σ_m--mean stress, θ--angle

[Continuation of HARBIN GONGYE DAXUE XUEBAO No 4, Dec 80 pp 95-102]

characterizing strain). The equations of interlines between various reions are also given.

Finally, the location of typical metal forming processes in the stress plane is shown in a figure from which the tendency of variation of three orthogonal sizes can be judged, and the resistance and plasticity of metal-forming processes can also be compared.

AUTHOR: WANG Qilong [3769 0366 7127]
YIN Shuyan [3009 2885 6056]
ZHANG Jiuhai [1728 0046 3189]
QIAN Yiyu [6929 0044 0151]

ORG: All of the Welding Department

TITLE: "The Controllability of the Arc Appearance and Its Relation to the Metal Transfer Modes in the Pulse MIG Welding Process"

SOURCE: Harbin HARBIN GONGYE DAXUE XUEBAO [JOURNAL OF HARBIN INSTITUTE OF TECHNOLOGY] in Chinese No 4, Dec 80 pp 103-116

TEXT OF ENGLISH ABSTRACT: This paper has discovered that arc appearances in the pulse MIG welding process are controllable. The technological characteristics of the pulse arc can be regulated to some extent by controlling the arc appearance. The different visible arc appearances are dependent on the changing process of the instantaneous arc appearances. This paper has examined the effect of pulse current waveform, pulse current amplitude, shielded gas and other factors on this changing process, and offers possible ways to control the arc appearance. Different arc appearances determine the different metal transfer modes. Through the comparative study of metal transfer modes in both flat and overhead welding positions by high-speed photography, the authors of this paper suggest that both single-droplet and multi-droplet transfers per pulse are axial and powerful in flat

[Continuation of HARBIN GONGYE DAXUE XUEBAO No 4, Dec 80 pp 103-116]

and overhead welding, but the multi-droplet transfer mode per pulse can have a broader region of welding conditions than can the single-droplet mode.

The arc jumping phenomenon is a common physical essence of the streaming transfer mode. The essential change of the liquid wire tip and the appearance of the streaming transfer feature take place only after the arc jumping phenomenon. The process of streaming transfer of continuous current arc jumping phenomenon appears only once at the starting stage of the arc, while the process of pulse streaming transfer arc jumping phenomenon repeates in every pulse current period.

In both the single- and multi-droplet transfers, the per pulse droplet can detach and transfer after the end of the pulse current period (i.e., during the base current period). This may contribute to the inertia action of the transfer mass and to the instability of the liquid metal column on the wire tip, which separates into several pieces and then forms small droplets which transfer to the weld pool.

AUTHOR: XIE Hongzheng [6200 7703 2398]

ORG: Department of Mathematics

TITLE: "The Uniqueness of the Solution for Linear Parabolic Differential Equations"

SOURCE: Harbin HARBIN GONGYE DAXUE XUEBAO [JOURNAL OF HARBIN INSTITUTE OF TECHNOLOGY] in Chinese No 4, Dec 80 pp 117-124

TEXT OF ENGLISH ABSTRACT: In this paper, further discussed is the uniqueness of the solution for various initial and boundary value problems in semi-infinite and finite domains on the basis of a discussion of the uniqueness of the Cauchy problem and the First Boundary problem of finite domain for the second order linear parabolic differential equations.

AUTHOR: CHU Zaixiang [5969 6528 4382]
CHEN Shouren [7115 1343 0088]
CHEN Hongpan [7115 1347 4149]

ORG: All of the Automated Instruments Department

TITLE: "Radiant Emission Characteristics of Non-isothermal Diffuse Blackbody Cavities"

SOURCE: Harbin HARBIN GONGYE DAXUE XUEBAO [JOURNAL OF HARBIN INSTITUTE OF TECHNOLOGY] in Chinese No 4, Dec 80 pp 125-132

TEXT OF ENGLISH ABSTRACT: Using the integral equations or approximate-zone method, calculations of effective total and effective spectral emissivities for non-isothermal diffuse blackbody cavities have been represented. In addition, several concerned angle factors of the baffled conical cavities are derived in this paper. Some typical results of the cylindrical and conical cavities have been solved on a digital computer and are given here. However the general procedure used to evaluate the radiant emission characteristics of a non-isothermal cavity is omitted.

AUTHOR: QI Zhenkai [2058 2182 7030]

ORG: Department of Mathematics

TITLE: "Fuzzy Meta-groups"

SOURCE: Harbin HARBIN GONGYE DAXUE XUEBAO [JOURNAL OF HARBIN INSTITUTE OF TECHNOLOGY] in Chinese No 4, Dec 80 pp 133-138

TEXT OF ENGLISH ABSTRACT: In this paper we give the isomorphism theorem for fuzzy meta-groups and fuzzy normal meta-group series, and the theorem of fuzzy meta-group series on some particular monoid such as a Gaussian monoid or a free commutative monoid.

AUTHOR: CUI Minggen [1508 2494 2704]

ORG: Computational Mathematics (Graduate Student)

TITLE: "The Convergence of the Factor of Stable Hermite Polynomial Interpolation of the First Class"

SOURCE: Harbin HARBIN GONGYE DAXUE XUEBAO [JOURNAL OF HARBIN INSTITUTE OF TECHNOLOGY] in Chinese No 4, Dec 80 pp 139-147

TEXT OF ENGLISH ABSTRACT: Condition * is introduced and a sufficient condition for the convergence of Hermite polynomial interpolation (case $\alpha_1 = \alpha_2 = \ldots = \alpha_n = 2$) is given. The roots of a class of orthogonal polynomials (including Tschebyscheff polynomials and Legendre polynomials) satisfy the condition *. Taking them as points of interpolation, Hermite interpolation polynomial $H_m (f, x)$ converges uniformly.

9717
CSO: 4009

AUTHOR: YIN Zhiqiang [3009 1807 1730]
WEI Zhiyuan [7614 1807 3220]
WU Jiaqing [0702 1367 1987]
TAO Zuyan [7118 4371 1484]

ORG: All of Department of Radio Electronics, Qinghua University

TITLE: "A Magic Glass Vacuum Tube Capable of Collecting Solar Energy"

SOURCE: Beijing XIANDAIHUA [MODERNIZATION] in Chinese Vol 3 No 2, Mar 81 pp 2-3

ABSTRACT: On a cold wintry day of -10°C, someone dashed out of a classroom building of Qinghua University to pick up a black colored glass tube, a little more than one meter in length and as big around as an arm. After he reached inside, he pulled out the plug from the glass tube, and poured out the water in the tube into waiting tea cups. Hot tea was done in a little while. The glass tube had been filled with cold water 3 hours previously and placed outside to "freeze" in the sun. The cold water was hot enough to brew tea! This glass tube is the glass vacuum solar collecting tube jointly made by Qinghua University, Beijing Electron Tube Plant, and Beijing Blass Instrument Plant. If dozens of these tubes are put together a very promising solar energy utilization device is formed. The tube has the appearance of a long Thermos bottle, except for the fact that the external tube is transparent, while the inner tube is coated with a special paint. The solar energy collecting

[continuation of XIANDAIHUA Vol 3 No 2, 1981 pp 2-3]

capacity of the vacuum tube is higher than the flat board type solar collector and its useful life is longer. On a roof of a certain factory, measuring 800m^2, 8,000 such tubes were installed, and hot water was provided for that plant every day. In China, aside from Sichuan and Guizhou, all the other provinces are suitable for solar energy utilization. Drawings are included to explain the structure of these solar energy collecting vacuum tubes.

AUTHOR: CAI Shanyu [5591 6365 6877]

ORG: Institute of Nuclear Energy, Chinese Academy of Sciences

TITLE: "Polonium in Modern Science and Technology"

SOURCE: Beijing XIANDAIHUA [MODERNIZATION] in Chinese Vol 3 No 2, Mar 81 pp 14-16

ABSTRACT: In July 1898, Marie and Pierre Curie announced their discovery from the slag of uraninite ore a substance with radioactivity 400 times higher than uranium. They named it polonium, in honor of Poland, Marie's native country. This is the first radioactive element being discovered, followed by the discovery of radium and the subsequent arrival of the age of nuclear energy. There are 27 isotopes of polonium containing different numbers of neutrons in the nucleus, with the mass number varying from 192 to 218. All of them release α-radiation. The most important of them, polonium-210 radiates α particles of 5.3 MeV of energy. Its γ radiation is weak, only one γ photon to every 100,000 α particles. It is, therefore, a high ratio α source. When it is used to bombard a light element target nucleus, such as beryllium or boron, a large quantity of neutrons may be produced; therefore, it is also a high source of neutron. One g of polonium can release 144w of energy, while the density of metal polonium is 9.4 g/cm^3; therefore, its power density is as high as 1340 w/cm^3. Various applications of polonium due to these special properties are explained.

AUTHOR: CHEN Yingzhen [7115 2019 3791]
ZHENG Jinbiao [6774 6855 2871]

ORG: None

TITLE: "Electric Power Streaks Forth From the Mighty Waves"

SOURCE: Beijing XIANDAIHUA [MODERNIZATION] in Chinese Vol 3 No 2, Mar 81 pp 40-41

ABSTRACT: Following a discussion of ways of harnessing tho power of ocean waves to generate electricity, the paper explains that China has a continental and island coastline of 32,000km on the Pacific Ocean, with an average wave height of about 1m. The estimated capacity, the paper states, is 3,000-5,000 Mw of electrical power capable of being developed along the coast alone. The Japanese ship Haiming [transliteration] which generates electricity on the high sea and transmits the power to the land is mentioned, with drawings depicting the theory of the power generation process.

6168
CSO: 4009

AUTHOR: LIANG Xixia [2733 1585 0204]
GU Shiwei [7357 0013 3161]

ORG: Both of Nei Monggol University

TITLE: "Properties of an Exciton in Polar Crystal"

SOURCE: Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTOR] in Chinese No 1, 1981 pp 1-6

TEXT OF ENGLISH ABSTRACT: In this paper, from the effective Hamiltonian obtained by one of the authors, analytical formulas of the ground state energy and wave function of an exciton are derived respectively by means of the variational method in cases of both a small and large radius. A detailed analysis of each term of these formulas is given.

AUTHOR: HE Hongjia [0149 1347 1367]
CAO Funian [2580 4395 1628]
FAN Tiwen [5400 4895 2429]
et al.

ORG: All of the Institute of Semiconductors, Chinese Academy of Sciences

TITLE: "Investigation of Microdefects and Microprecipitates in Te-doped GaAs"

SOURCE: Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTOR] in Chinese No 1, 1981 pp 7-13

TEXT OF ENGLISH ABSTRACT: In this paper, the microdefects and microprecipitates in Te-doped GaAs grown by the horizontal Bridgman method are investigated by chemical etching, anodic etching, optical microscope and TEM. The distribution relationship between the microdefects and dislocations is obtained. It is found that these microdefects and their present forms depend on the carrier concentration of the sample. These microdefects are mostly extrinsic faults and extrinsic Frank Loops with precipitates, and the hillock or S-pit revealed by etching corresponds to the cluster of these microdefects observed by TEM.

AUTHOR: ZHAO Wenqin [6392 2429 3830]

ORG: Shanghai Institute of Technical Physics, Chinese Academy of Sciences

TITLE: "Isolation Effect of Damage Caused by Proton Bombardment on InSb"

SOURCE: Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTOR] in Chinese No 1, 1981 pp 14-21

TEXT OF ENGLISH ABSTRACT: The isolation effect in InSb due to the damage caused by high energy proton bombardment is studied and applied to the solution for extension of the responsive areas of InSb infrared detectors and the problem of the crosstalk in detector arrays.

Proton implantation is carried out at room temperature by an ion implantation equipment or an electrostatic accelerator with the energy range from 40 KeV to 2 MeV, and the dose range from 10^{13} to $10^{16}/cm^2$. The damage isolation effect has been studied by use of the double crystal diffractometer, the distribution of responsivity by a small light spot with a diameter of 100 μm, the electric measurement of crosstalk, and the frame-rate scanner.

All the results of the tests mentioned above signify that the isolation of proton bombardment is a suitable method for the electric isolation technique. It can be

[Continuation of BANDAOTI XUEBAO No 1, 1981 pp 14-21]

used in solving the extension of responsive areas of infrared detectors and the problem of crosstalk in a detector array. This method can also be used for developing planner devices.

AUTHOR: HE Mincai [0149 3046 2088]
ZHAO Xiaomin [6392 1420 2404]

ORG: Both of the Department of Physics, Wuhan University

TITLE: "Transient Analysis of Phototransistor Time Parameters"

SOURCE: Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTOR] in Chinese No 1, 1981 pp 22-28

TEXT OF ENGLISH ABSTRACT: Starting from the photoelectric transient processes of phototransistors, the time parameters are derived and the response times are measured. The experimental results are in good agreement with the theoretical analysis.

AUTHOR: SHI Zhongbin [4258 0112 2430]

ORG: Department of Physics, Wuhan University

TITLE: "Measurement Analysis of the Bulk-generated Leakage Current of the Silicon Avalanche Photodiodes"

SOURCE: Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTOR] in Chinese No 1, 1981 pp 29-35

TEXT OF ENGLISH ABSTRACT: The bulk-generated leakage current is an important parameter in the application of avalanche photodiodes, however the surface leakage current cannot be separated from the bulk-generated leakage current by using the conventional method. In this paper, a method for measuring the bulk-generated leakage of avalanche photodiodes is suggested, the correlative expressions are given and the bulk-generated leakage current of a silicon avalanche photodiode is analyzed.

AUTHOR: YANG Yufen [2799 3768 5358]

ORG: Institute of Semiconductors, Chinese Academy of Sciences

TITLE: "A Large Signal Theoretical Analysis of IMPATT Avalanche Diode"

SOURCE: Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTOR] in Chinese No 1, 1981 pp 36-44

TEXT OF ENGLISH ABSTRACT: An analytical expression of large signal impedance of p^+NN^+ IMPATT diode is given for the case of unequal ionization rates of electrons and holes under the condition of uniform avalanche region. The theoretical results are applied to diodes of 4 mm band. Output power and efficiency are calculated and compared with the experimental results.

AUTHOR: TANG Weilang [0781 1919 3809]

ORG: Shandong University

TITLE: "Theoretical Analysis of Silicon Avalanche Diodes with PTF > 1 and Uniform Carrier Drift Velocity"

SOURCE: Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTOR] in Chinese No 1, 1981 pp 45-54

TEXT OF ENGLISH ABSTRACT: n^+pp^+ (or p^+nn^+), n^+pn^+ (or p^+np^+) and MSM type silicon avalanche diodes with PTF > 1 and uniform carrier drift velocity are studied by means of an equation of terminal voltage which is derived from Poisson's equation and the equation of continuity under certain assumptions. Analytical solutions in closed form are obtained by the method of successive approximation. It is shown that an AC negative resistance occurs over the frequency range from 0 to a certain characteristic value. The negative resistance is small at low frequencies. It increases in magnitude as the frequency increases, reaching a minimum at a certain frequency. Then the resistance rises rapidly through zero to positive values, reaching a maximum. After that, it decreases and approaches zero asymptotically.

AUTHOR: DENG Zhaoyang [6772 0340 2254]

ORG: Institute of Semiconductors, Chinese Academy of Sciences

TITLE: "A Fast Versatile TD-TTL Relaxation Oscillator"

SOURCE: Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTOR] in Chinese No 1, 1981 pp 55-64

TEXT OF ENGLISH ABSTRACT: This paper gives a composite TD-TTL relaxation oscillator circuit. This circuit makes comprehensive use of the features of two fast devices, tunnel diode and fast TTL, and constitutes a feedback network by means of voltage-controlled current source and timing capacitor. Thus it presents a series of excellent electrical performances in the field of pulse circuit, such as good waveform, high speed, wideband frequency coverage and convenience for programming control as well as versatility, etc.

This paper also presents analyses and studies on TD and TTL interface configuration and on the oscillating period of the elementary circuit. It gives illustrations of several fast versatile circuits, and lists performance features and application prospects of the elementary circuit.

9717
CSO: 4009

AUTHOR: PENG Guoxian [1756 0948 6343]

ORG: None

TITLE: "Plane Television"

SOURCE: Beijing WUXIANDIAN [RADIO] in Chinese No 2, 11 Feb 81 pp 16-17, 2[illegible]

ABSTRACT: In foreign countries, a new type of television has appeared. Unlike ordinary television receivers, its picture display device is only a few centimeters in thickness and may be hung up on the wall like a picture frame. Unlike ordinary television receivers, digital circuits are used. Its electroluminescence display screen, gaseous discharge display screen, or liquid crystal display screen are explained in terms of their difference in structure and merits and demerits. Essential of the new control circuits are also briefly discussed. The major problems in future development of this new type of television involve simplification of circuits to reduce cost and the realization of color. At present, the luminescence efficiency is still low, the useful life of the set short, the differentiation rate and stability poor. These problems will have to be resolved through improvements in the structure of the set and the choice of materials used before plane television sets will replace the ordinary picture tube and be popularized.

AUTHOR: YI Mingguang [2496 0342 690D]
YU Tian [7183 3944]

ORG: None

TITLE: " F006 Integrated Operation Amplifier Circuit Analysis"

SOURCE: Beijing WUXIANDIAN [RADIO] in Chinese No 2, 11 Feb 81 pp 37-39

ABSTRACT: In the No 8, 80 issue of this journal, common unit circuits inside an integrated operation amplifier were introduced. On the basis of that paper, and using the China made F006 integrated operation amplifier as an example, this paper introduces the complete circuitry of the integrated operation amplifier for the purpose of providing an overall view of its internal work condition. The F006 is an all purpose operation amplifier. Its technical indices, such as voltage gain, input impedance, the work voltage range, etc. are all relatively even to satisfy the requirements of most applications, to correspond with the famous foreign circuit μA741. The diagram of the F006 may appear to be rather complicated, but if it is dissected, each part may be clearly observed as being composed of basic unit circuits. This paper divides the integrated circuit into 4 major components: the major bias circuit and the constant-current source, the differential input stage, the high gain amplification stage, and the output stage and output short circuit protection circuit for the purpose of clarifying the work procedure of the integrated circuit.

6168
CSO: 4009

AUTHOR: XU Qinghua [1776 1987 5478]

ORG: Institute of Vertebrate Paleontology and Paleoanthropology, Chinese Academy of Sciences

TITLE: "Discovery of the First Ramapithecin Skull in the World"

SOURCE: Beijing KEXUE SHIYAN [SCIENTIFIC EXPERIMENT] in Chinese No 3, 81 pp 1-2, inside front cover

ABSTRACT: The announcement of the Central People's Broadcasting Station on 26 Dec 80 of the discovery of the first Ramapithecin skull in the world in Lufeng, Yunnan Province brought a great deal of response here and abroad. In Japan, especially, it was printed as an important news item in all major newspapers the next day. One of the editorials even suggested that it may provide evidence that Ramapithecines walked on 2 legs. This paper traces briefly the fossil evidences of the evolution of man, starting with the discovery of jaw bones, etc. of Dryopithecines in France in 1856, that of upper jaw bone and teeth of Ramapithecines in Siwalik of India in 1932, and again in Hungary, Turkey, etc. in the late 60's to the early 70's, etc. Since the discovery of fossils of Ramapithecines and a large quantity of other animal fossils in Lufeng of Yunnan in 1975, diggings have been carried out continuously in that location and the first 8 million year old skull was discovered on 16 Dec 78. The skull, upper and lower jaw bones, and teeth of Ramapithecus and a large quantity of other

[continuation of KEXUE SHIYAN No 3, 81 pp 1-2, inside front cover]

mammalian fossilsunearthed at the site have now been transported to Beijing and restoration work is being earnestly performed. When the restoration work is complete, it will be possible to estimate the size of the Ramapithecin brain, and to determine whether the foramen occipitale magnum is in the middle and hence to judge whether the Lufeng Ramapithecin was able to stand straight and walk on 2 legs. The Mystery of whether the Lufeng Ramapitecin was a man or a ape will soon be resolved to clarify the problem of the origin of man.

AUTHOR: LI Zongchun [2621 1350 4783]

ORG: None

TITLE: "Rubber Highway"

SOURCE: Beijing KEXUE SHIYAN [SCIENTIFIC EXPERIMENT] in Chinese No 3, 81 p 26

ABSTRACT: In many areas of the world, a layer of ice and snow covers the highways all winter to cause transportation very difficult and accidents are often caused by it. In the past, salt is used to make the snow melt away. The frozen pavement will thaw and the snow and ice melt in 3 hours after salt is scattered on the road surface but the salt will corrode the metal on the cars, affect the growth of trees on the side of the highway, cause a rapid and sudden change of the sodium chloride density of the streams, and influence the normal living of freshwater organisms. At present, the Designing Academy of Construction Engineering of the USSR is studying these problems. They are considering the use of used rubber tires to pave roads, instead of sand and gravel. It is much easier to break up used tires into little fragments than to break stone. Ice is almost never formed on the rubber pavement. If there should be small pieces of ice, they will be crushed when a car runs over the small pieces of rubber. More importantly, the rubber pavement reduces vibration and its useful life is one third longer than the traditional pavement. According to the USSR specialists, if all the used tires of that country are thus utilized, several thousand km of highway may be paved every year. The existing rubber paved experimental road suface is functioning very satisfactorily.

AUTHOR: YU Zhihua [0151 1807 5478]

ORG: None

TITLE: "Fatherless Animals"

SOURCE: Beijing KEXUE SHIYAN [SCIENTIFIC EXPERIMENT] in Chinese No 3, 81 pp 36- 37

ABSTRACT: From asexual propagation to sexual propagation is a mark of evolution of life. But, scientists say that the form of sexual propagation in high class animals has its advantages as well as shortcomings. The most important shortcoming is the fact that the offsprings will necessarily preserve the genetic characteristics of both parents so that the most superior of the species cannot pass on all his or her characteristics to the offsprings. Since the beginning of the 20th century many biologists of different countries have devoted their lives on this problem, the breakthrough came when single-parent frogs and rats were born. In China, Prof. zhu Xi [2612 0405] was the first to obtain a normal adult frog with the parthenogenetic method of propagation in the 50's. In the spring of 1979, the Wuhan Institute of Marine Biology Chinese Academy of Sciences used the cell of Jiyu [a species of domestic fish; Carassius auratus] of the blastodermic stage of development to culture continuously for 59 generations in 385 days. The cell nucleus of the cell thus cultured was transplanted into the unfertilized egg of Jiyu with its own nucleus removed first. In Apr 80, with this procedure, they successfully obtained 2 Jiyu fingerlings. One of the two developed normally for more than 80 days to measure 8cm in length. A photo of that fish is reproduced. Various methods of artificial parthenogenesis are discussed.

6248
CSO: 4009

AUTHOR: WU Xiuheng [0702 4423 1854]
QUAN Guijun [0356 6311 0971]
LI Shimo [2621 0013 6206]
LIU Yaoming [0491 5069 2494]

ORG: All of the Wuhan Water Transportation Engineering Institute

TITLE: "Experimental Study of the Navigability on the Waterway of the Gezhou Dam Model by a Free Running Push-train Model"

SOURCE: Wuxi ZHONGGUO ZAOCHUAN [SHIPBUILDING OF CHINA] in Chinese No 1, 1981 pp 43-50

TEXT OF ENGLISH ABSTRACT: This paper states the influence of the scale effect of the push-train model (scale 1:100), the compensation method and the navigation test on the waterway of the Gezhou Dam model. According to the experiments, it was demonstrated that the scale effect of the ship model is obvious, but it can be compensated for by reducing the area of the side rudder of the pusher. The results of the experiments are stable and the fluctuation is reasonably small, although the ship model has to be made rather small because of the retraction of the scale of the dam model. Thus, the small-scale ship model can be used to research the navigation conditions through the waterway in the dam model.

The experiments also show that using a free running push-train model can represent correctly the improvement of navigation conditions in various design plans.

AUTHOR: WU Weiliang [0702 0251 5328]

ORG: Shanghai Ship and Shipping Research Institute

TITLE: "On a Discussion of the Shallow Draft Vessels Used in the Transportation of China"

SOURCE: Wuxi ZHONGGUO ZAOCHUAN [SHIPBUILDING OF CHINA] in Chinese No 1, 1981 pp 81-89

TEXT OF ENGLISH ABSTRACT: In this paper, the main technical problems of the shallow draft vessel are discussed and a preliminary conclusion is given on whether the shallow draft vessels used in coastal or sea-going transportation will be economical or feasible in accordance with the state of the water depth of China's harbors:
(1) When the permissible draft T of a vessel in a very shallow harbor is less than 0.75 times the unlimited draft T_0 of a conventional vessel ($T < 0.75\ T_0$), the unloading part cargoes at C.T.S. (Central Terminal Station) are applicable.
(2) When the permissible draft is between 0.75 T_0 and T_0 ($0.75\ T_0 \leqslant T < T_0$), the shallow draft type vessel will be applicable.

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